SUMMARIZING THE MILK RIVER WATER SUPPLY STUDY

Montana
Department
of
Natural Resources
and
Conservation

Helena, Montana

Milk River
Irrigation District

Malta, Montana

U. S. Department of the Interior
Bureau of Reclamation
Great Plains Region

Billings, Montana

July 1990

SPECIAL REPORT

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SUMMARIZING THE
MILK RIVER WATER SUPPLY
STUDY

MONTANA DEPARTMENT OF
NATURAL RESOURCES AND
CONSERVATION
HELENA, MONTANA

MILK RIVER IRRIGATION
DISTRICTS
MALTA, MONTANA

U.S. BUREAU OF RECLAMATION
GREAT PLAINS REGION
BILLINGS, MONTANA

JULY 1990

PREFACE

This report is comprised of comments received on the field draft Milk River Water Supply Study Plan Formulation Working Document and Reclamation's responses, along with a revised version of the PFWD. The field draft of the PFWD was distributed to involved state and federal agencies, the Indian tribes in the area, irrigation districts, and interested private parties. The revised field draft in this report concludes the study by summarizing the information gathered to date.

As detailed in the summary of the report (see pages S1 to S-17), the Milk River Water Supply Study is divided into three phases: Phase 1, appointment of a joint board of control by the Milk River irrigators and restoration of the St. Mary Canal to its original capacity of 850 ft^3/s, is already in operation. Phase 2, to repair and improve project facilities and improve management of both the irrigation systems and the use of water on the farm, could be implemented. For the Glasgow and Malta Irrigation Districts, Phase 2 could be carried out under the Bureau of Reclamation's Rehabilitation and Betterment Program. Pick-Sloan Missouri River Basin Program power revenues may be available to help pay off project costs beyond the irrigators ability to pay, but only if Congress authorizes this arrangement. The Chinook Division and the Dodson District are ineligible for the R&B Program, but they could use the Small Projects Loan Program for Phase 2, with Congress again authorizing the use of P-SMBP power revenues.

Augmenting the water supply in the Milk River Basin by constructing a canal from the Missouri River to the Milk, Phase 3, would require a Regional Director's planning report/environmental impact statement. Continuation of Phase 3 must await resolution of two issues:

1. The reserved water rights of Indians remain unsettled. Until the Indians receive a full water supply, the amount of water available to the other irrigators is unknown. Solution of the Indian entitlement may involve other adjoining river basins;

2. Water rights in the basin must be adjudicated to demonstrate a need for Phase 3. Twenty-five thousand acres are presently irrigated in the basin under junior water rights, while senior water rights cannot be fully met. Until water rights are fixed and enforced, those with junior rights will feel no need to add to the supply of water available for irrigation;

Phase 3 cannot be pursued until Indian and non-Indian water rights are quantified. Thus, the Milk River Water Supply Study is being concluded.

Contents

Appendices
(Printed in Separate Volumes)

COMMENTS ON THE DRAFT

PLAN FORMULATION WORKING DOCUMENT

AND RECLAMATION'S RESPONSES

UNITED STATES GOVERNMENT

memorandum

DATE March 7, 1989

REPLY TO ATTN OF GP-150

SUBJECT Plan Formulation Working Document (PFWD), Milk River Water Supply Study (Your Memorandum Dated February 15, 1989) (Water Supply Study)

TO GP-700

We have completed our review of the subject document. The following comments and the enclosed, edited PFWD are the results of the review:

1. Pages S-3, S-5, and 4-15 -- In addition to inventorying and evaluating the historical significance of the water delivery system and appurtenances, it will be necessary to inventory areas to be impacted by field leveling and other earth disturbing activities not directly associated with the water delivery system.

The paragraph on Table S-3 and on p. 4-15 has been changed to read: ". . . surveys will be taken where earth-disturbing activities are to take place."

2. Pages S-8 and 4-33 -- Additional cultural resource inventory may be necessary for access roads, borrow areas, construction staging areas, previously uninventoried and unplowed land which will become irrigated land, and any areas where the canal route deviates from the route inventoried in 1985 and 1986. No formal determination of eligibility for the National Register of Historic Places has been made for any of the cultural resource sites recorded along the canal route. The Montana Projects Office will consult with the Montana State Historic Preservation Officer regarding the eligibility of all of the sites, and any mitigation which may be necessary. It is possible that more or less than three sites will be determined to be eligible for the National Register.

A paragraph has been added on Table S-3 and on p. 4-33 as follows: "Cultural resources on access roads, borrow areas, construction staging areas, unplowed lands to be irrigated, and areas where the canal route was changed from the 1985-86 cultural resource survey will also be inventoried. Reclamation will consult with SHPO on the eligibility of any finds and on possible mitigation."

3. Page 4-25, fourth paragraph -- Even though no land has to be acquired [illegible] Federal land at Lonesome Lake is utilized for mitigation, compensation may have to be made to individuals who would lose their grazing leases. If other management options are to be used (other than the elimination of grazing), they should be mentioned.

A statement has been added to the paragraph that some grazing rights might have to be purchased.

4. Page 4-30, second paragraph -- We do not believe that the statement "These species will not be affected by the Preferred Plan." can be made at this time because the cumulative effects of Phases 1 and 2 are not yet known. The report for Phase 3 will have to examine the cumulative effects of all 3 phases in order to reach a "no effect" or "may affect" decision on threatened or endangered species. In other words, the final operation scheme of Nelson Reservoir is not known at this time. Piping plover habitat may increase or decrease depending on differences in water level fluctuations between pre-project and post-project conditions. Therefore, we suggest stating that informal consultation with the FWS will continue through development of the entire project in order to avoid impacts to threatened or endangered species.

A sentence has been added to p. 4-30 as follows: "Consultation with the U.S. Fish and Wildlife Service will continue through development of all three phases of the project to ensure that threatened and endangered species are not affected."

5. Page 4-32 -- We suggest modifying the first sentence by adding, ". . . were sampled to a depth of 10 feet and analyzed to determine the potential for water quality changes resulting from the introduction of soluble trace elements." Furthermore, the conclusions should be briefly

Done.

stated here rather than left open to question; this would make this discussion consistent with the subsequent discussion on pesticides.

6. This document should convey the message that the computed shortages and thus the canal sizing are based on very uncertain values for conveyance and on-farm efficiencies. Therefore, the 230 ft^3/s sizing of the Virgelle-Mill Canal is very tentative. A detailed "actual use and efficiency study" should be included as the concluding effort for Phase 2. This study would provide the basis for Phase 3 evaluation and, if appropriate, sizing.

7. Table 5.3 -- Should water quality be included as an environmental factor?

If you have any questions concerning our comments, or require additional information, contact John Boehmke at 657-6240.

Enclosure

cc: Project Manager, Billings, Montana
Attention: MT-400, -425

The conclusions have been stated as you suggested.

Since this study is to be concluded, no further engineering work will be done on it.

The water quality factor has been added to Table 5.3.

UNITED STATES GOVERNMENT

memorandum

DATE March 2, 1989

REPLY TO ATTN OF GP-200

SUBJECT Plan Formulation Working Document - Milk River Water Supply Study (Your Memorandum Dated February 15, 1989)

TO GP-700

We have reviewed the subject document and have the following comments:

1. Page 4-23, near bottom of the page, item 1--Add "The drain water would be pumped back into the canal." Done.

2. Page 4-23, near bottom of the page, item 2--Delete "winter)." and add . . . "periods when the canal is unwatered." Done.

Thank you for the opportunity to comment on this report.

J M Verzuh

C-15

OPTIONAL FORM NO. 10
(REV. 1-80)
GSA FPMR (41 CFR) 101-11.6
5010-114

UNITED STATES GOVERNMENT

memorandum

[illegible], Attention: [illegible] GP-450

Review of the Plan Formulation Working Document, Milk River Water Supply Study (1 of Memorandum of February 15, 1989) (Water Supply Study)

GP-700 [illegible]

We have reviewed the subject document and offer the following comments:

1. Summary Section, Page S-1 - The year "1988" should be included in the discussion of the recent examples of shortages years. At the bottom of the page, the last sentence should be the first sentence beginning on Page S-2.

Nineteen eighty-four represents the worst year on record; therefore, it was highlighted in the report.

2. Figure S.1, Page S-4 - The values indicated at the top of each bar, 1.0 Ac., .8/Ac., etc., need to include additional information and are not consistent with the units on the vertical scale. We suggest the values be designated by 1.0 AF/Ac. (See Figure 4.1, Page 4-11 and Figure 4.2, Page 4-14.)

Done.

3. Page 1-2 - Under Diversion Facility, move the terms "Fort Belknap Diversion Dam" and "Vandalia Diversion Dam" to the left. In the last paragraph, the term "grass-forb moisture" should be replace with "grass-forb mixture."

Done.

4. Page 1-4 through 1-5 - All of the plans described in this section will have to be subject to the Boundary Water Treaty allocation. This should be stated in this section. On Page 1-5, under Number 6 - the power drops analysis is for the St. Mary's Canal, not the Milk River Canal.

It is not conclusive that the water claims of the Indian Tribes are bound by Boundary Water Treaty, so no mention was made of the Treaty in this section.

5. Page 2-1, last paragraph - The term "thereby the degress" should be replaced with "thereby the degrees."

Changed.

6. Page 2-2, third paragraph - The second to the last sentence should include the phrase, "in excess of 1 AF/Ac."

Done.

7. Page 2-3, first paragraph - Rewrite the first sentence to read, "In 1967, all of the districts and the owners of the 11,000 acres under pump contract signed an equalization pact that gave an equal right to the water supply for the Milk River Project." In the second paragraph, the notation is made of 55 Montana water rights recorded along the Milk River. Does this number include the tributaries as it appears low?

Done: "exclusive of tributaries" added to second paragraph.

8. Page 2-5, last paragraph - The first sentence states, "Milk River Project irrigation water shortages are critical." Actually the water supply is critical and the shortages produce a burden on the livelihood of the Milk River irrigators. The sentence should be rewritten to read, "Milk River Project irrigation water supplies are critical to the well being of the valley. Continued irrigation shortages produce an unwelcome burden on the livelihood of the irrigation districts and contract pumpers."

Changed.

9. Page 2-7, last paragraph, sixth sentence - This sentenee is incomplete. Additional language should be added to elarify the intended thought. In addition, the term "at this time" should be replaeed with "at the time."	Sentenee deleted; phrase in question changed.
10. Page 3-4, last paragraph - It should be noted that only the main stem of the Milk River has been elosed to new water rights.	Done.
11. Page 4-29 - Replace the word "annual" with "annually."	Done.
12. Page 4-31, first paragraph - The preferred plan is to replace Virgelle Canal Diversion with storage water from Lake Elwell. It should not be a foregone conelusion that this water is available without eompensation. Water may not be available during dry years. It may be neeessary for the Milk River distriets to obtain a water right for Missouri River water or to enter into an agreement to secure Lake Elwell storage water. This water would then be released to maintain the required instream flow. Table 4.4 should be expanded to provide additional clarity. The required instream should be shown with the impacts subtracted from them. This will display the actual impacts of the diversions on the Missouri River.	Done.
13. Page 4-32, second paragraph - The word "peirods" is misspelled. It should be "periods."	Done.
14. Page 4-36 - The OM&R estimate was based on 47 miles, not 46 miles as stated in the report.	Changed.
15. Page 4-38, Table 4.4 - First, this is the second Table marked 4.4. Page 4-31 also has a table numbered 4.4. We suggest all of the figures be rounded off to the nearest one thousand dollars. At present, there is no consistency between the values.	Table number changed here and on the later tables in Chap. 4; figures rounded.
16. Page 4-64, second paragraph - The phrase "would pass passed through" should be replaced with "would pass through."	Word deleted.
17. Page 6-6 - The term "Missouri River Region" should be replaced with "Great Plains Region." In the last paragraph, the words "proposed" and "provided" are capitalized. They should be lower case.	Done.
18. Page A-5 - The on-farm effieiency for the Irrigation Distriet gravity systems (27 percent) is not defined in the narrative. We suggest the determination and background of this figure be included.	The 27 percent on-farm effieiency for the irrigation district was estimated by Reelamation in eonjunetion with the Soil Conservation Service. The SCS measured onfarm effieiencies in the summer of 1986 in the counties where the irrigation distriets are located. The SCS also did onfarm efficiency studies in selected Valley County farms over a period of years. The data for the present study supports the 27 pereent on-farm effieiency for district lands.
19. Page A-8, Second paragraph - The number one footnote should appear after the word "loss" not before it. The last sentence should be rewritten to read, ". . . 20 pereent the next month, and 10 percent in the third month." In the third paragraph, the word "cause" should be replaced with "results in." There is an extra comma after the word "streamflows", it should be deleted.	Done.

20. Page A-1a - The symbol "@" appears in the word Dryland Alfalfa Hay. It should be removed.

Done.

If you have any questions concerning these comments, contact Rick DeVore.

James A. Rollins

United States Department of the Interior
BUREAU OF RECLAMATION
Missouri Basin Region
Montana Projects Office
P.O Box 30137
Billings, Montana 59107-0137

IN REPLY
REFER TO

MT-100

MAR 7 1989

OFFICIAL FILE COPY

MAR - 8 1989

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700		

Memorandum

To: Regional Director, Billings, Montana
Attention: GP-700

From: Project Manager, Billings, Montana

Subject: Milk River Water Supply Study (PFWD)

Thank you for the opportunity to review the subject report. We find it very complete in addressing all possible alternatives. It is well integrated with our Rehabilitation and Betterment studies. The PFWD draft is enclosed with our comments marked in.

J. L. Woodward

Enclosure

Comments taken from draft copy.

UNITED STATES GOVERNMENT

memorandum

Reply to Attn of:

Denver, Colorado
DATE: March 02, 1989

TO: Chief, Program Services Division
Attention: D-5150 (Smith)

FROM: Chief, Engineering Division

SUBJECT: Review of the Draft Plan Formulation Working Document (FPWD), Milk River Water Supply Study, Montana (FPWD)

We have completed our review of the subject report. Certain changes and revisions related to the Virgelle - Milk River 230-ft³/s Canal Alternative construction cost estimate need to be considered or accommodated depending on the future intent of the FPWD.

If the plan is to proceed with a Regional Director's Planning Report/Draft Environmental Assessment, the changes must be accommodated in order to ensure the engineering technical adequacy of the FPWD. We feel that if the FPWD is to be converted into a concluding report, the engineering adequacy is satisfactory as is. However, the changes and revisions must be adequately documented so that they will be considered in any future renewed action on the study.

General comments

Page 5-2, third paragraph, third sentence - second "junior" water rights should be changed to "senior."

Done.

Page 5-3, second paragraph - change last sentence to read "... effective use of water supplies, maintenance equipment, and personnel."

Done.

Page 4-6, first paragraph, second sentence - PVC should read "membrane material."

Done.

Page 4-19, third paragraph, third sentence - "river bottom" should read "river alluvium."

"Bottom" connotes that water is being drawn from the river, not from the banks.

Specific cost estimate comments

Page 4-24, Summary of Costs, footnote 2/ - 15 percent contingencies must be a typing error. Nothing less than 25 percent contingencies would be acceptable at this level of investigation. If not a typing error, the costs for drainage must be revised.

The 15 percent figure was a typing error. It has been corrected.

Page 4-38, table 4.4 - the January 1987 costs should be indexed to January 1989 and a check made on the impact for an economic re-analysis. A 2-year-old price base cost estimate is normally too out of date for use in an official report.

Since the study is being concluded, another economic analysis would be superfluous.

The construction cost for project rights-of-way should be broken out and shown as a line item cost. If this cannot be readily accomplished, a statement should be made that right-of-way costs are included in the cost of the facilities.

A statement to the effect that right-of-way costs are included in the cost of facilities has bee added to this table.

The PFWD makes reference to the need for cultural resources or archeological mitigation investigations. The specific cost for archeological investigations should be shown as a line item cost.

Archeology cost is not an economic cost in the economic analysis. This cost would have to be included in the cost estimate for Congressional authorization.

Page 4-39, fifth paragraph - a 2-year construction period for a project of this magnitude in a northern climatic construction area is inadequate. For the purpose of this PFWD, a 4-year construction period would be a more appropriate time period.

As the study is to be concluded, the length of construction period will not be reconsidered.

Several of the above specific cost estimate comments are also applicable to the 200-ft^3/s and 175-ft^3/s Canal Alternative plans and appropriate revisions would have to be made to these cost estimates.

If you have any questions, please contact Phil Kyburz, extension 67799.

cc: D-5200
D-5220
D-5222 (Kyburz)

Memorandum

To Manager, Planning Services
attention D-5150

From Chief, Analysis, Contracts, and Lands Division

Subject Analysis, Contracts, and Lands Division Review Comments of the Milk River Water Supply Study Plan Formulation Working Document (Water Supply Study)

We have reviewed the subject document and we cannot approve the PFWD until the following comments have been accommodated

1 The approval of the PFWD is withheld pending the determination of the use to be made of the document and the correction of the mathematical errors listed are made in the document

2 The future without the project is not clearly defined The anticipated system efficiency after completion of Phase 2 work should be presented so that the unmet water needs can be evaluated

3 Additionally the assumptions regarding the outcome of the pending adjudication need to be clearly stated On page 4-3, the report states "Phase 3 was formulated to provide an adequate water supply to the landowners with junior water rights, Gros Ventre-Assiniboine Tribes on the Fort Belknap Reservation " This raises the question as to whether this supply is in addition to the tribe's reserved right; this needs to be clarified

4 The needs analysis does not have adequate supporting documentation The basis for determining the needs for the town of Chinook, Bureau of Land Management stockponds, and the Bowdoin National Wildlife Refuge need to be documented

5 The PFWD only presents one alternative with three different canal sizes It appears, with the extremely low irrigation efficiencies used, that if possible implementation of additional conservation measures would be a reasonable alternative to construction of the canal

6 The financial analysis of Phase 2 states that the sizing of the Rehabilitation and Betterment program is limited by the repayment ability of the irrigators Clarification of the different methodology used in the derivation of the payment capacity in Phase 2 versus that used in the payment capacity determination in Phase 3 is needed

7 Reference is made to a Multi-Attribute Tradeoff Systems (MATS) Analysis; however, the analysis is not presented anywhere in the report

8 The analysis of social impacts from the development of newly irrigated Indian lands is not adequate Merely stating that the lands would be irrigated does not address the social implications of that action

9 It is proposed that the costs for Rocky Boy's Reservation be paid by the Federal Government to assure the social well-being of the reservation There

C-10

Differences between the alternatives were expressed in terms of shortages, not system efficiencies.

A statement has been added that the water supply from the Virgelle Canal would not be in addition to the Fort Belknap reserved right; instead, this water supply would be a part of the reserved right.

Since the study is to be concluded, documenting the needs further is unnecessary.

Conservation measures in the PFWD were accepted after much discussion with interested water users. Besides, the canal would not be built until 10 years after installation of the conservation measures, allowing time to prove whether the efficiencies as estimated with conservation are correct or not.

Payment capacity in Phase 2 was figured on one budget analysis; results showed no payment capacity available, but there was a willingness to pay, from an increase in equity. Willingness to pay is acceptable in the R&B Program criteria. In Phase 3, payment capacity was computed using budgets "with" and "without" irrigation development. This is an acceptable way to compute payment capacity under the U.S. Water Resource Council's Principles and Guidelines.

Page 5-5 described MATS and refers readers to Table 5.2, "Comparison of Social Accounts."

No further work will be done on social impacts since the study is to be concluded.

The Leavitt Act defers repayment by Indian water users to promote social well-being on Indian reservations, which is what the report was referring to.

is no support for this recommendation in the social analysis	
10 The social implications of lands being severed by the proposed canal route need to be addressed.	The implications would be minimal with a canal crossing about every mile and with 90 percent of the 46 miles of canal located next to an existing railroad.
11 In addition to a listing of public involvement activities, a summary of the results of these activities is needed	As the study is to be concluded, no more work will be done on it.
12 The PFWD should be supported with the submission of the repayment and benefit farm budgets for review and approval.	See the reply to item 11 above.
13 According to Reclamation instructions, for the use of facilities method of cost allocation to be used prior approval should be obtained.	See the reply above.
14 If costs are updated and the construction schedule is changed many economic changes will be required	-
15 The following corrections of mathematical and typographical errors should be made	
A Page 4-8, last paragraph. The diversion demand at the headgate should be rounded to 5.9 acre-feet per acre.	Corrected.
B Page 4-40, Table 4.5, Footnote 5 The OM&R energy cost should be $45,000 and total OM&R costs are $313,000.	Corrected.
C Page 4-40, Table 4.5, Footnote 7. Fish and wildlife energy costs are $75,000 and total benefits are $122,000.	Corrected
D Page 4-40, Table 4.5, Footnote 8 Bureau of Land Management OM&R cost derivation should be 7,500 acre-feet times $3.72/acre-foot or $26,000. The total benefits would be $72,000.	Corrected.
E. Page 4-40, Table 4.5, Footnote 9 Derivation of the unemployment benefits is $52.5 million construction costs times $3,023/$1,000,000	Corrected.
F Page 4-40, Table 4.5 The OM&R costs are $313,000 and total costs are $6,418,000	Corrected.
G Page 4-40, Table 4.5 Fish and Wildlife benefits are $122,000, Bureau of Land Management benefits are $72,000, total benefits are $6,269,000, and net benefits are $149,000.	Corrected.
H Page 4-43, first partial paragraph Total annual equivalent costs should read $6,418,000 The benefits associated with these costs are $6,265,000; for a minus $149,000.	Corrected.
I Page 4-43, tabulation. The Fish and Wildlife diversion is 12,700 acre-feet and the total diversion is 44,100 acre-feet.	Corrected.
J Page 4-45, tabulation middle of page The $6,820,000 allocated costs divided by 19 years equals $359,000/25,000 acres.	Corrected.
K Page 4-45, tabulation bottom of page. The total annual subsidy for	

canalside irrigators should be $274,000

L Page 4-46, Table 4.6, Footnote 1 It should read derivation is shown on page 4-44

M Page 4-46, Table 4.6 The O&M for the Fort Belknap tribes is $1.45 per acre

N Page 4-48, last paragraph The total annual benefits for the 200 cfs alternative is $5,782,000

O Page 4-49, Table 4.7, Footnote 4 It should read 220' TDH

P Page 4-49, Table 4.7, Footnote 7 The Fish and Wildlife energy benefits are $75,000 and total benefits are $119,000

Q Page 4-49, Table 4.7, Footnote 8 Total Bureau of Land Management benefits are $70,000.

R Page 4-49, Table 4.7 Under benefits fish and wildlife is $119,000, total benefits are $5,782,000, and net benefits would be $307,000

S Page 4-51, first paragraph The reference should be to table 4.8

T Page 4-52, Table 4.8 Eliminate footnote 6

U Page 4-55, Table 4.9, Footnote 1 Cost of the 175 cfs canal and pumping plant is $37,000,000

W Page 4-55, Table 4.9, Footnote 4 Cost of energy is based on 34,800 acre-feet diversion

X Page 4-55, Table 4.9, Footnote 7 Energy for Fish and Wildlife benefits is $75,000 and total benefits are $119,000

Y Page 4-55, Table 4.9 Fish and Wildlife benefits are $119,000 and total benefits are $5,287,000 The net benefits are $787,000

Z Page 4-56, Table 4.10, Footnote 2 It should read "Canal-7,300/34,800 "

If you have questions regarding the social aspects of the comments please contact Debby Saint at Ext 61172 and the questions regarding the economic aspects should be referred to Rob McKinley at Ext 63526

bc D-5400
D-5430
D-5431
D-5440
D-5441 (McKinley)

The figure has been rounded to $274,00.

Corrected.

Corrected.

Corrected.

Corrected.

Corrected.

Corrected.

Corrected.

The reference has been changed to Table 4.9, which is correct in the new numbering system.

Corrected.

Corrected.

Corrected.

Corrected.

Corrected.

UNITED STATES GOVERNMENT

Memorandum

Denver, Colorado

: Chief, Resource Suitability Branch DATE: March 13, 1989

ROUGH: Head, Land Suitability Section

: Joseph Brummer and Willie Forest

JECT: Comments on Milk River Water Supply Study (PFWD) (Land Classification)

The land classification is fully adequate for feasibility studies in most areas. Only the Fort Belknap Reservation has an uncertain land base at the present time. Currently, there is no technical basis for the reservation land estimates. A Reclamation approved land classification is normally required prior to Federal authorization. This classification would be required on all lands that are to receive supplemental water. Reclamation's review of the Bureau of Indian Affairs (BIA) land classification would be the next logical step towards authorization. — Noted.

Page 52, third paragraph, third sentence: . . . was only adequate for senior water rights.

Page 3-4, paragraph 3, sentence 2: Take sentence out or make the following change: — Done.

The BIA is currently classifying the reservation lands using their standards. This classification will be used in water right negotiations. — Done.

Standards Table 3-2: Class 2h should read (light clay permitted in top 12 inches).

Page 3-6: The following paragraph should be inserted at the bottom of the page: — Done.

Supporting data for the land classification study is listed below: — Done.

1. Big Sandy Valley Lands Appendix.
2. Milk River Valley Lands Appendix.
3. Milk River Equilibrium Study Report.

This data is on file at the Great Plains Regional Office, Billings, Montana.

Joseph Brummer
Willie Forest

3-13-89

Head, Land Suitability Section

I Concur 3/14/89

Chief, Resource Suitability Branch

cc: D-5710
D-5715

WBB:JBrummer:ls:3/13/89:X60189
D-5715-1:COMMENTS1

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

UNITED STATES GOVERNMENT

memorandum

Memorandum

TO: Manager, Environmental Services
Attention: D-5150 (Gappa)

Denver, Colorado
DATE: March 17, 1989

FROM: Chief, Ecological Resources Division

SUBJECT: Plan Formulation Working Document (PFWD), Milk River Water Supply Study (PFWD)

We reviewed the subject document as requested by your ACRM-1 of February 22, 1989, and we have potentially significant concerns regarding the adequacy of the formulation effort and its reporting. In general, the report lacks the amount of detail and quantitative environmental information customary to support a decision on the selection of a preferred plan. The report should present a clear description of the project's impacts upon the significant environmental resources as a basis for determining, among other things, the adequacy of proposed mitigation.

More information should be provided on specific animal and terrestrial plant species found within the area of impact and the types and amount of vegetation lost and particular wildlife species impacted. Particular attention should be given to wetland impacts (types and amounts). Where practicable, areas of impact should be identified on maps.

Finally, appropriate reports or other documents from Federal and State fish and wildlife agencies should be referenced, and pertinent information included in the report to support conclusions about the adequacy of mitigation recommendations.

To accommodate our technical concerns in a rewrite of the PFWD may require a substantial amount of time. However, if the necessary environmental information is available and it can be demonstrated that significant environmental concerns have been adequately addressed, including acceptable mitigation, the document may not need revision from this perspective. This could be accommodated in the PR/EIS and appendixes. We have no way of knowing whether this is the case. We would be available to discuss these issues with the region and to try to arrive at a solution that meets both our needs. Therefore, at this time, we cannot provide you with a meaningful estimate for the service agreement to revise the PFWD. Should you wish to discuss this further with this Division, our contact and potential team member will be Dr. Fred Pinkney (GS-12).

In addition to our general observations, we have included some more specific comments that should be addressed in any rewrite of the document.

- The conclusion on page 1-3 that the Blackfeet proposals would not affect the formulation does not appear to be supported.

Since the study is to be concluded, no further analysis will be done.

- The amount of land to be managed in the Lonesome Lake area (page 4-2S) should be identified along with the effect of this management. We are also aware of interests to add enhancement features to the plan for this area (see also page 6-8). The significance of this proposal should be discussed.

- Fencing costs have not been included in the cost estimate, but the recommendation to fence the canal right-of-way has been adopted (page 6-7, item 5).

- The effect of non-Pick-Sloan power rates on the Missouri River pumping costs should be shown in the document.

- The statement on page S-8 indicates that the Phase 3 effort focused only on the canal selection, which seems to indicate that other alternative water sources, if they exist, were not evaluated. This could represent a significant deficiency in the process.

- For cultural resources management in the Federal program, there are two basic items Federal agencies must deal with in satisfying their responsibilities.

  1. Compliance with National Environmental Policy Act (NEPA).

  2. Compliance with the appropriate sections of the National Historic Preservation Act of 1966 (NHPA). This is generally Section 106 but may also involve Section 110 (f). Compliance with those requirements is carried out through implementation of the steps in 36 CFR Part 800 ("Protection of Historic Properties").

  Section 106 responsibility is independent of NEPA responsibility, and it must be completed even when the NEPA process does not proceed.

  Documents used for NEPA compliance must show one of two things:

  1. That NHPA responsibilities have been completed.

  2. That NHPA responsibilities will be completed in the future.

  This document does neither of these things. It does indicate that some of the steps which might be used to comply with 36 CFR Part 800 have been implemented, but the commitments made do not demonstrate that Reclamation has or intends to comply with NHPA requirements through 36 CFR Part 800. It is also unclear whether Class III surveys have been carried out in all areas where there will be ground disturbance. If they have, then that should be stated. If they have not, then a commitment to complete surveys in areas not previously surveyed should be made. Once that issue is addressed, then it is necessary to revise the document to clearly state Reclamation's commitments regarding compliance with appropriate sections of the NHPA.

- On page S-8 the paragraph might be changed to read:

A Class III cultural resource survey of the canal route revealed 14 prehistoric and historic sites in the right-of-way. The consultant recommends that three of these sites be considered eligible or potentially eligible for the National Register of Historic Places. Of primary concern is the Great Northern Railroad and some associated features which have been determined eligible as a district for the National Register of Historic Places. Other potentially eligible sites include prehistoric stone circles with rock cairns and artifact scatters. Each identified site will be evaluated, and determinations of effect will be made in consultation with the Montana State Historic Preservation Officer. In subsequent management of the project's effect on sites determined eligible for the National Register, 36 CFR Part 800 will be followed.

Changed.

- On page 4-32 et. seq. the paragraphs might be reorganized to read:

Cultural Resources. - A class III cultural resource inventory was conducted by archeological consultants. [IS ADDITIONAL SURVEY NECESSARY OR DOES THIS MEAN THAT ALL GROUND DISTURBANCE AREAS WERE SURVEYED--PLACE THE APPROPRIATE STATEMENT HERE]. Fourteen prehistoric and historic sites, of which three were recommended as potentially eligible or eligible for listing on the National Register of Historic Places, will be affected by the canal route. Two of these are in a direct line with the intake of the river, within the first mile. These sites are potentially eligible and include stone circles with rock cairns and cultural material scatters. The other site is the Great Northern Railroad, portions of which were previously recorded as historic (24CH585) (also designated 24HL869 in Hill County), which has been found eligible for the National Register by the Montana State Historic Preservation Officer. The Great Northern Railroad has been designated eligible for the National Register as a historic district.

Changed.

The proximity of the canal route to the Great Northern Railroad will result in visual effects to the eligible district as well as physical effects wherever it crosses the railroad. The canal will physically affect the other two sites which may be eligible for inclusion in the National Register (IS THIS TRUE???).

Consultations with the Montana State Historic Preservation Officer and the Advisory Council on Historic Preservation will be conducted in accordance with 36 CFR Part 800 to assure that the requirements of Section 106 of the National Historic Preservation Act of 1966 are carried out.

Statement changed in accordance with GP-150 archeologist's comments.

- There are numerous arithmetic rounding errors apparent in the information on pages 4-40 through 4-41 as well as other typographical errors. We have retained a marked-up copy of the document for further reference if this information is of interest.

George H Walker

cc: D-S500
D-S522 (McFarland)
D-S522 (Pinkney)

WBR:JHokenstrom:hs:3-17-89:68399
(WPSO:B:MILKRIV.MEM)

(O/P 445)

UNITED STATES GOVERNMENT

Memorandum

TO: Chief, Resource Suitability Branch

DATE: Denver, Colorado
March 15, 1989

THROUGH: Head, Water Quality Section

FROM: James Yahnke

SUBJECT: Review of Plan Formulation Working Document - Milk River Water Supply Study (Water Quality)

In March 1986, we reviewed the plan of study for the Milk River Water Supply Study. At that time we commented on water quality to the effect:

> "Water quality data collection and analyses activities for return flow are not explicitly defined, but it appears that an irrigation return flow analysis will be required, especially for new lands. The data collection effort should be directed toward addressing all of the questions connected with return flows."

The section on water quality (page 4-32) seems to have taken the relationship to return flows to heart; however, this has been to the exclusion of all other considerations. The entire water quality impacts discussion, with the exception of one sentence (reference to temperature impacts on the Milk River), is devoted to a description of soils and soil sampling. There is absolutely no indication that any data on existing water quality of potential receiving streams have been or will be collected. It would seem that there will be an estimate of the quality of the irrigation returns; however, these returns will be entering a vacuum. If there are no data on the quality of the receiving stream, the impact of additional or different quality return flows cannot be evaluated. Are there any problems now? If so, will they be exacerbated? Do we have an opportunity to improve the existing situation?

There is an allusion to the questions raised above in the discussion of water shortages on the Bowdoin National Wildlife Refuge (page 2-9). There are references to saline/sodic soils, saline seeps and discharges, and effects on downstream irrigators. All of this seems to relate to water quality, although no actual data are presented. Much of this discussion seems to be related to water quality and the goals of the study, but unlike much of the water supply material, it is unquantified. As a "working document," much additional work and documentation are needed, at least as it relates to the water quality aspects of the study.

The Department of the Interior Task Group on Irrigation and Drainage conducted a study of the Milk River Project and the Bowdoin National Refuge. The report

Since the study is to be concluded, no further analysis will be done.

on that study presents a large body of data, including some that were attributed to the Bureau of Reclamation. These are apparently data collected for the Milk River Water Supply Study. Since the Department has another interest in the study area, reference to this other study, including the problems documented, should be an integrable part of the water supply study. In addition, the conclusions from Departmental study indicate that additional water is needed at the refuge. This is one of the problems that the water supply study is attempting to solve, a fact that could provide support for any of the construction alternatives that may be selected for construction later.

A quick review of published USGS water data indicates that temperature and specific conductance are reported at many stations on the Milk River and its tributaries. If the principal water quality concern is salinity, these data may be sufficient to assess any impact. If there are other concerns, then additional data will probably be needed. The USGS also operates a NASQAN station at Nashua near the mouth of the Milk River. This station has a rather complete suite of constituent analyses, and it may be useful to assess a cumulative impact of any development. To make the working document technically adequate, some discussion of existing water quality, available data, existing problems, and the potential degree of improvement or degradation should be included.

James H. Yahnke

cc: D-S710
D-S711

WBR:JYahnke:js:3/15/89:X63778
D-S711:REVIEW1

Noted 3/15/89
Head, Water Quality Section

Noted 3/15/89
Chief, Resource Systems Analysis Branch

UNITED STATES GOVERNMENT

memorandum

Memorandum

O: Manager, Environmental Services
Attention: Stan Gappa, D-5150

DATE: March 20, 1989

ROM. Chief, Earth Sciences Division

UBJECT: Review of the Milk River Water Supply Study Plan Formulation Working Document (Water Supply)

The Milk River Water Supply Study Plan Formulation Working Document was reviewed as requested by the February 15, 1989 service agreement. The review was primarily made for completeness and clarity of the report. Since supporting technical documentation was not provided as a part of the review package, very few comments can be made about the technical adequacy of the procedures and data in the analysis.

The following comments are provided to improve the report.

1. The summary needs expansion to include a description of the problems and needs of the Rocky Boy Reservation and private canalside irrigated areas. The water shortages should also be described for the project.

2. The discussion about irrigation shortages which begins on page 2-5 quantifies the acres irrigated but does not quantify the volume of water needed to satisfy the crop requirements. At a minimum, the average annual water shortage should be quantified and presented in this section of the report.

3. Table 3.1 shows a significant amount of Class 4a and 4b land. When the land classification specifications were presented in table 3.2, the characteristics of Class 4 land were omitted.

4. The irrigation shortages for the Milk River Project were divided into mean annual facility shortages and water supply shortages. The sum of these values represented total shortages. Use of these terms in this manner is a bit confusing. In order for a mean annual facility shortage to occur requires the diversion requirements to exceed the canal capacity; therefore, the facility shortage is really a part of the water supply shortage. The report should be corrected to show the water supply shortage as the difference between the diversion requirements and the present supply.

5. Figure 3.1 is confusing. The current canal capactity should be quantified and labeled on the figure. The diversion requirement should also be labeled for clarity.

The study is to be concluded - no further analysis will be done.

No - CIR's and annual demand are explained in Chapter 4 (p. - 4-8) and elsewhere. Further explanation is unneeded in general discussion of needs.

Class 3X on Table 3.1 represents the lands you mention (which are actually closer to Class 3). The lands were classified 3X in response to an earlier comment from the Denver Office.

In some cases canals cannot carry diversion requirements.

The study is to be concluded; no further work will be done on it.

6. Were the canals sized with the idea of delivering water to meet the peak 10-day delivery requirements? The information presented in the report seems to reflect only the average delivery rates.

Canals are sized for 10-day delivery requirement.

7. Estimated historical irrigation efficiencies are shown in Attachment 1 in the [illegible], but the expected onfarm and conveyance efficiencies resulting from Phase 2 system improvements for the future without project condition have not been described. This information should be included in the report because it forms the basis for determining the project diversion requirements.

Differences are shown in shortages rather than in efficiencies.

8. Many typographical errors and misspelled words are in the report. In numerous locations, numbers are tabulated and rounded to varying degrees of accuracy. For example, sometimes tables show acreages rounded to the nearest 100 acres or 1,000 acres which are added to acreages estimated to the nearest acre. Some tabulated data is also not added correctly. When modifications are being made to this document, a marked-up copy of the report will be provided.

If you have any questions about this review, please contact Mr. Robert Swain of my staff (extension 6-0018).

cc: 0-5100 (w/o encl), 0-5300 (w/o encl), 0- 5750, (w/o encl), 0-5752 (w/o encl)

WBR:RSwain:jal:3/20/89:236-0018
(5752-20:MILK)

MAJORITY DEPUTY WHIP
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LABOR STANDARDS
INTERIOR
SUBCOMMITTEE
NATIONAL PARKS AND PUBLIC LANDS

PAT WILLIAMS
MONTANA (FIRST DISTRICT)

2453 RAYBURN BUILDING
WASHINGTON, DC 20515
(202) 225-3211

DISTRICT OFFICES
BUTTE
(406) 723-4474
PINTLER COMPLEX
59701
HELENA
(406) 443-7878
32 N. LAST CHANCE GULCH
59601
MISSOULA
(406) 549-9550
302 W. BROADWAY
59802

Congress of the United States
House of Representatives
Washington, DC 20515

April 11, 1989

Mr. Roger K. Patterson
Acting Regional Director
Bureau Of Reclamation
U.S. Department of the Interior
P.O. Box 36900
Billings, Montana 59101

Dear Mr. Patterson:

I am aware of the comments that have been submitted to you on March 17, 1989 regarding the Milk River Water Supply Study PFWD, and I urge you to carefully consider the points included in the letter submitted by the Blackfeet Tribal Business Council.

It is important that the potential water supply and use of Milk River/St. Mary's waters on the Blackfeet Reservation be included in federal water planning efforts for the Milk River Basin.

Best regards.

Sincerely,

Pat Williams

Pat Williams

See the reply to the Blackfeet Tribe's comments.

C-22

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
LEWISTOWN DISTRICT OFFICE
[redacted]

IN REPLY REFER TO
7200

John Lawson, Regional Planning Officer
Bureau of Reclamation
P.O. Box 36900
Billings, MT 59107-6900

Dear Mr. Lawson:

Thank you for the opportunity to review the Plan Formulation Working Document (PFWD), Milk River Water Supply Study. The document answers several of our questions regarding BLM's involvement in Phase III of the plan. However, we believe that a number of serious issues remain unresolved:

1. Level of detail in the PFWD is not sufficient for evaluation of the wildlife mitigation areas. Identification of areas and a description of how mitigation will proceed is needed.

2. The current Memorandum of Understanding (MOU) between our two agencies regarding stockwater development and potential revisions to the MOU are not addressed.

3. Resolution of how BLM would fund its portion of Phase III development is needed.

4. Our records indicate we have been asked to comment on only one portion of the study to date, that being the draft EA for the R & B Program of the Glasgow Division, Milk River Project. The comments offered to that report do not seem to be addressed in the PFWD.

5. Effects on flora and fauna in the UMNWSR due to releases from Tiber Dam and withdrawals through the pumping facility were not addressed.

Due to the lack of involvement the Lewistown District has had to date with the study, I feel it is in the best interests of both agencies to resolve potential conflicts as soon as possible through a meeting. The meeting would address the concerns listed above and determine the need for BLM's involvement in future Milk River water supply actions.

The PFWD is a more preliminary report than an EIS. All of the comments below probably would have been resolved during the process of writing the EIS. Since the study is to be concluded, however, no further work is considered necessary.

At the present time, the Levistown District is not able to adequately assess the FFWD. A meeting would improve our understanding of the project and allow us to offer more constructive comments to the plan.

If you have any questions, please contact Joe Frazier, District Hydrologist, at this office (406) 538-7461.

Sincerely,

General Comments on Mill Creek Feasibility Study PFWD

Comment	Response
- Bind report instead of staple. Stapled falls apart too quickly	Noted.
- Very little consideration of water quality. Even if this will be partially addressed in EIS but should also be considered here. Avg CIR ≅ 12" but is additional field application for leaching required? What is EC of irrigation water? Does it vary temporally or spatially? Will increased irrigation system reduce downstream water qual so that crop yields are reduced?	Water quality information would have been further developed in the EIS. Present information is sufficient for the more preliminary PFWD.
- Lack of figures. Consider adding a large map or maps (or a few small maps) - and all locations discussed (i.e. creeks & headgates, districts, reservations, etc.)	Noted, but no new maps or figures will be prepared for this report.
- As I understand it, Fresno reservoir is currently operated to max. storage of [illegible] 30,000 ac-ft or less to prevent bank erosion. Isn't this a facility problem that should be addressed in the R&B or R&C plans? How much will annual shortage decrease if Fresno were rip rapped and could store up to its max capacity?	Fresno Reservoir concerns are beyond the scope of the present report.

- Would ranking of various plans considered have (i.e. IWD, proposed, etc) changed if Canadian Reservoir already exists or will be reasonably expected to be completed during the life of these projects? Do benefit/cost ratios change?

Construction of the Canadian Reservoir was considered in light of the information available at the time the PFWD was written. The Canadian reservation would change needs considerably, as the report now admits.

- In general many terms were used without stating precise quantifications or determinations of what was meant (i.e. large, shortage, etc) I have marked as many of these as I could. Also many conclusive statements were made w/o any foundation or basis from which the reader might logically arrive @ the conclusion. Insertion of many references is also needed.

Qualifications have been added where possible, and references listed.

- Many other comments, questions & suggested changes exist in the text

Noted.

BLACKFEET NATION
P. O. BOX 850
BROWNING, MONTANA 59417
(406) 338-7179

EXECUTIVE COMMITTEE

OFFICIAL FILE COPY
MAR 21 '89
700
105
720

TRIBAL COUNCIL

March 17 , 1989

Roger K. Patterson
Acting Regional Director
Great Plains Region
Bureau of Reclamation
U.S. Department of the Interior
P.O. Box 36900
Billings, Montana 59101

RE: Milk River Water Supply Study PFWD

Dear Mr. Patterson:

The Blackfeet Tribe very much appreciates the opportunity to comment on the Milk River Water Supply PFWD. As the primary source for the water supply for the various American and Canadian Milk River Irrigation projects arises on the Blackfeet Reservation, we take special interest in the study. We also appreciated the opportunities you have afforded us to consult with you. The Blackfeet Tribal Business Council has directed me to forward the following comments to you.

In comparing the treatment of the effect on Blackfeet Treaty Rights in this document with the treatment afforded Blackfeet treaty rights in the Forest Service's environmental planning documents, we believe that this PFWD is inadequate in that it does not reflect our consultations with your agency.

Following is a description of points we think should properly have been included in the PFWD. Attached is a list of specific language in which we find objectionable.

INCLUSION OF ALL AMERICAN PLAN ALTERNATIVE IN PHASE 2

The All American Plan was originally proposed as a viable alternative in the original Milk River Project planning. Most importantly, it offers significant benefits to the Blackfeet Tribe, benefits which are long over-due. To date the Blackfeet Tribe has not received any benefit from the Milk River Project or the St. Mary Diversion Canal, although both significantly affect the Blackfeet Indian Reservation.

The All-American Plan proposed diverting water from the Waterton, Belly, and St. Marys Rivers in Glacier National Park into the Milk via a 21-mile long tunnel. Because of the location in the park and engineering difficulties, a feasibility study was never completed on this plan.

The keys to water management are flexibility and control of storage. The All American Plan not only offers the United States protection against a severe prolonged drought which could one again bring American water independent sentiments into play, but also offers many storage facilities along the route of diversion.

We would like to discuss with you how further study of the All American Route will be treated in the next planning document. We are not satisfied that our past consultations are reflected in the present PFWD and hope that the next document, whether it is a P-S MBP study document or a concluding report will include more discription of the All American Plan alternative.

In terms of the All American Plan as an alternative, how could the St. Mary's/Cut Bank Diversion not be included, if it was included as an alternative at the time the Federal Government planned the Milk River Projects? Another alternative was also considered at that time -- the creation of irrigation projects, within the Blackfeet Reservation along the St. Mary's Diversion Canal.

BLACKFEET POTENTIAL TO AFFECT THE LOWER MILK RIVER SPONSORS.

The present officially recognized Milk River project sponsors do not include the Blackfeet Tribe. Yet the Blackfeet Tribe itself may want to consider becoming a sponsor of a P-S MBP program as the present sponsors. A portion of a Blackfeet P-S MBP that could well affect the downstream Americans on the Milk River. The Blackfeet Tribe has to look to the St. Marys supply as the most feasible source for the reservation lands North of Cut Bank Creek. The diversion of at least the 90,000 acre feet presently available in the St. Mary's must be considered as an alternative in Blackfeet Water planning. Despite your Agency's present unsatisfactory inclusion in the PFWD of that portion of the All American Plan alternative which would increase Blackfeet irrigation, we will continue to consider the two Blackfeet alternatives in our water planning and hope that your agency will do so in the future.

A discussion of water development options of the Blackfeet Tribe has been added to Chapter 1 of the PFWD. Since the report is to be concluded, however, no further development of the plans will be done.

GOVERNMENT TO GOVERNMENT TREATMENT OF THE BLACKFEET TRIBE IN THE FEDERAL ENVIRONMENTAL PLANNING PROCESS FOR THE MILK RIVER BASIN.

In addition to requesting the correction of the deficiencies in the PFWD specifically listed in the attachment, the Blackfeet Tribe further requests that: Scoping meetings for further environmental document preparation be held on the Reservation; the Blackfeet Tribe be permitted to designate a Tribal Representative to any federal inter-agency working group involved in environmental planning for the Milk River Basin; that the Blackfeet Tribe be given, in advance of its

The Blackfeet Tribe will be kept informed of the progress of this study. It should be noted, however, that the study is being concluded and little further work will be devoted to it.

C-15

public release, any major Federal Environmental Document on the Milk River Basin; and that the Blackfeet be officially notified prior to decisions being made which result in changes to federal activities in the Milk River Basin.

The credibility of any effort to plan for basin-wide management of the Milk River is considerably lessened by not fully including those alternatives which consider the treaty rights and potential implementation of those rights of all Indian Tribe within the basin. Certainly finding the solution to persistent Milk River shortages is in the best interests of all the Tribes affected just as much as it is in the interests of the non-Indian Milk River irrigators.

We would very much appreciate a response to the Blackfeet concerns described in this letter and its attachment. Should you wish to discuss any of these matters prior to preparing a written response, please feel free to call our Water Department Director, Steve Pollock (406)338-7401.

104

Sincerely yours,

Bernard St. Goddard acting

TOM WHITFORD, SR., Chairman
Blackfeet Tribal Business Council

TW:VS/pw

attachment:

cc: Max Baucus
Conrad Burns
Pat Williams
William Gipp
Chairman, Rocky Boy
Chairman, Fort Belknap
Chief, Blood Tribe

C-29

BLACKFEET SPECIFIC COMMENTS ON PFWD LANGUAGE

Page and Paragraph		
S-1, 1st Paragraph	The specific date for construction of Lake Sherburne and St. Mary's Canal should be included.	The intent of this paragraph was to give the reader a general background of the facilities. A more detailed discussion would have been inconsistent with that intent.
Last Paragraph	Should include potential Blackfeet legal share of St. Mary's and Milk.	Since the study is to be concluded, no further work on specific points of the study is to be done.
S-2, 2nd Paragraph	Add Paragraph on effect on Blackfeet, especially in light of initial discussion in early project history of Blackfeet Irrigation distribution system from St. Mary's Canal.	
S-3, 2nd Paragraph	Include descriptions of on-going discussions with Blackfeet Tribe on mitigation of environmental effects.	See reply above.
S-8, Last Paragraph	Add short paragraph discussing potential All American Plan Alternative and potential Blackfeet distribution system from St. Mary's Canal.	See reply to comment on the first page of your letter.
S-14	No discussion of the truly ancient problem of St. Mary's Canal, seepage.	See reply above.
1-3, 2nd Paragraph Line 5-6	We do not understand how the All-American Plan, or any other Blackfeet proposal can be taken to automatically include an increase in the size of the proposed Virgelle Canal or the proposed Canadian Milk River Plan. We believe that consideration of the Blackfeet proposals would automatically increase the potential for the Virgelle Diversion and ultimately affect the Benefit-Cost Ratio if both proposals were reviewed jointly. We also believe that consideration would automatically affect the present U.S. foreign policy on the Milk River Dam.	This paragraph has been deleted.
1-5, Paragraph 3	Add a paragraph on Swift Dam Hydropower potential.	A paragraph has been added as requested.

Last Paragraph	Add a sentence mentioning original planning for the Milk River.	The last paragraph mentions the original plans for the Milk River.
2-3, Last Paragraph Line 4	The Blackfeet claim water rights since time immemorial. The Blackfeet Indian Reservation was established in 1855.	The date has been corrected.
2-7, Point 6	After adjudication, or a negotiated water settlement by any Tribe, there is no federal law stating that the Tribe must accept a state Water Master's enforcement of the Tribe's reserved quantified water right. The further problem after adjudication will truly be the early priority dates of tribal reserved water rights.	Noted.
3-1, 2nd Paragraph and p. 3-4 last paragraph	No inclusion of Blackfeet land classifications.	Since the study is to be concluded, land classification, water use, or environmental mitigation suggestions will not be further addressed.
3-8 & 3-9	Why not add the Blackfeet Indian Reservation to the computer simulation in Phase 2? The model will obviously take into account potential Canadian upstream activity. If it does not include potential upstream Blackfeet activity, then it will never reflect planning realities.	
4-2, Paragraph 3	No mention of on-going environmental mitigation discussions with Blackfeet Tribe on St. Mary Canal rehabilitation	See reply above.
4-3, Paragraph 3	No discussion of potential inclusion of any Blackfeet proposal Phase 3.	See reply above.
4-4, Paragraph 3	Here is an opportunity to present a more detailed discussion of Blackfeet mitigation discussions.	See reply above.
4-7	Sequence of events does not include Blackfeet Development of our full share of Milk River and St. Marys Water supply.	See reply above.

C-51

4-18	This is an apparently exhaustive study prepared for the Virgelle-Milk Canal. The Blackfeet believe that if this level of study was prepared for that canal, then the St. Mary-Cut Bank Canal of the All-American Plan requires at a minimum that same level of study, if the All American Plan is to be fully considered as an alternative.	The All American Plan is not considered as an alternative in the PFWD.
4-31, Last Paragraph	(Chart) does not address potential augmentation of Missouri Flow via St. Marys/Cut Bank Canal.	See the reply to your comments on p. 3-1 (above).
4-57, Paragraph 1	Why was the St. Marys/Cut Bank Canal not even mentioned as an alternative that was dropped from consideration? We raised this issue in our discussions with your agency and would appreciate any information on its current standing regarding future consideration.	See the reply to your comments on p. 3-1 (above).
5-7, Next to the Last Paragraph	NEPA regulatory compliance is undoubtedly also necessary. Indian Treaties, Agreements, Executive Orders and relevant Tribal Specific Statutes should also be included. The 1987 Amendments to the Clean Water Act also need to be added.	This list was not intended to be inclusive, but to suggest the Federal regulations and permits the study would comply with.

C-52

conservation DISTRICT
BOx 111 (406) 378-2298 BIG SANDY, MT 59520 0111

MAR 9 '89

United States Department of the Interior
Bureau of Reclamation
Great Plains Region
P.O. Box 36 Billings, Montana 59107-6900

Subject: Milk River Water Supply Study (GP-700)

Dear Mr. Mercer,

Milk River Water Supply Study concerns as expressed by the [illegible] County Conservation District.

A. SEEPAGE:

1. The parts of the canal to be lined are not spelled out as to what type lining will be used. 4-23

2. Lack of definition for linings. What is compacted earth? 4-23

3. Seepage is a real concern and the report does not guarantee that the seepage will be controlled. 4-24

4. Railroad route: With the canal following the B N line any seepage that would cause the track to slur would be reason for B N to close the line. This would be an economical disaster for the Big Sandy area.

The canal would have been more detailed in the planning report/EIS. Since the study is to be concluded, no more work will be done on detailed analyses.

B. WEEDS:

1. With the water of the canal and growing conditions from moist to arid this disturbed area will be an [illegible] area. The technology to control weeds along stream banks is not mentioned in this report.

2. The increased water will increase the bird activity that will in turn increase the weed seed dispersal rate.

3. The methods of weed control must be explained.

See above reply.

Donna Nilsson

1945 40 years 1985

C. CITY ROUTE:

1. The route of the canal through the city of Big Sandy is not mentioned.
2. At earlier meetings it was mentioned the canal would go through the city in a pipe underground. Will it?
3. The city is real concerned about potential danger from an open canal.

See above reply.

D. LONESOME LAKE:

1. What involvement does this canal project have with the future of Lonesome Lake?

See above reply.

E. COMMENTS:

1. We can not support this project until our concerns are satisfied.

Sincerely,

Robert Nelson
Big Sandy Conservation
DistrictSupervisor

cc: Glenn Braun, Chairman
Board of Supervisors

C-34

Chauvel Ranch
Big Sandy, Montana 59520
Darrell Chauvel
Box 147
Phone (406) 378-2383

March 7, 1989

MAR 9 '89

770

Ref 707
#770

United States Department of the Interior
Bureau of Reclamation
Great Plains Region
Billings, Montana 59107

To Whom It May Concern:

As spokesman for the Big Sandy Creek Landowners Association, I am writing to inform you of the concerns the association has about the currently proposed route for the Milk River Canal.

Proposed Route

The new proposal indicates this route will cut through some of the best irrigated hay meadows in the area. A large ditch through this area would limit flood irrigation as well as limit accessibility to some areas land owners now have easy access to. By limiting the amount of land available for hay production you are limiting the livlihood of some area ranchers.

The proposed route would also cut through a residential area in the town of Big Sandy. Would the footage going through this residential area be an underground pipe or open ditch?

Seepage

Seepage is a major problem in the Big Sandy area as it is now. We certainly do not need an open ditch adding to this problem.

Weeds

Because we have yet to see a project of the Bureau of Reclamation that isn't a weed breeding ground, we need some guarantee that this project will not be a repeat of your past performances. Weed infestation will destroy the surrounding hay meadows that are relatively weed free at this time.

Comments

A program of this magnitude should benefit all parties involved, not just some. In order to benefit those at the end of the projected route, your plan will destroy ranchers along the way. This appears as somewhat of a "Rob Peter to pay Paul" situation. Consideration should be given to the use of an underground pipeline through sensitive areas.

The study is to be concluded so no impacts will result from the project.

Chauvet Ranch

Big Sandy, Montana 59520

Darrell Chauvet | Box 147 | Phone (406) 378 2383

Unless a plan that is good for all concerned can be established, the landowners association is prepared to tie the project up in court--a benefit to no one. The Big Sandy Creek Landowners Association cannot and will not support this project until all concerns are worked out.

Sincerely,

Darrell Chauvet

Darrell Chauvet,co-chairman

Big Sandy Creek Landowners Association

March 8, 1989

United States Department of the Interior
Bureau of Reclamation
Great Plains Region

RE: Milk River Water Supply Study

TO: Mr. Derwood Mercer
Area Planning Officer

The City Council of Big Sandy, Montana, wishes to go on record opposing any canal installation involved with the Milk River Water Supply Project within a mile radius of the incorporated town of Big Sandy for the following reasons:

The growth and subsequent control of weeds will be a continual problem to the area with wind dispersal of seeds being a major problem to the residents who will be left to their own devices to curb a situation for which a solution has not been addressed by the Bureau.

An open canal with 7½ feet of water flowing presents an unacceptable problem that invites child exploration that no chain-link fence will prevent. Any open ditch within a one-mile boundary of the city limits becomes an "attractive nuisance" problem that we cannot afford to be present.

Availability of access to the city's water wells has not been explained to the city of Big Sandy.

And, as the governing body of Big Sandy, we would appreciate being contacted and visited by those individuals who may have the ultimate control of the placement of the canal route. Its location has changed frequently as well as the consideration as to whether the canal would be open or closed as it neared the city limits.

MONTANA
59520

Noted. The study is being concluded.

We feel we have a definite right to be made aware of your final canal placement proposal that may put the welfare of our constituents at risk - environmentally and physically. Please contact Mayor George Ament (378-2442) as to when a representative of the Bureau would be willing to survey, with the council members, that part of the route placement proposal which concerns the community of Big Sandy. Support of this project will not be forthcoming until the previously mentioned concerns are positively addressed.

With community interests concerned,

George Ament

Randy Beaudette

Wayne Turner

Ladene Mangold

Floyd Terry

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

STAN STEPHENS, GOVERNOR

STATE OF MONTANA

DIRECTOR'S OFFICE (406) 444-6699
TELEFAX NUMBER (406) 444-6721

LEE METCALF BUILDING
1520 EAST SIXTH AVENUE
HELENA, MONTANA 59620-2301

FEB 9'90

February 6, 1990

Mr. Mike Whittington
Regional Planning Officer
U. S. Bureau of Reclamation
P. O. Box 36900
Billings, MT 59107-6900

Dear Mr. Whittington:

Thank you for the opportunity to review the advanced copy of the Special Report, Summarizing the Milk River Water Supply. We have the following comments which you may wish to consider:

Page	Para.	Sent.	Comment
Preface	1	all	There is confusion regarding use of the terms "field draft", "revised field draft", "PFWD" and "Special Report". Clarify and use consistent terms throughout.
Preface	4	3-4	It is unclear to our Department why resolution of Indian Water Rights and adjudication of water rights are necessary pre-conditions for a planning report/environmental impact statement for Phase 3. Based on a survey conducted during 1989 by DNRC and the 49th Parallel Institute, junior water users do realize the need for additional water supply. Our survey found that these junior water users strongly (80%) supported seeking federal authorization and financial assistance for the three-phase plan. This is significant in that water users with contracts for water delivery from USBR favored seeking the plan only slightly more (81%).

The preface has been revised along the lines you suggest.

The rehabilitation, the construction and betterment, and the onfarm improvements of the Three Phase Plan could be accomplished without resolution of Indian water rights and adjudication of water rights. However, to implement the Third Phase would require resolution and adjudication of water rights. There is no way to physically demonstrate to the junior water users that they need water from a canal until adjudication with regulation is in place. Once these users have been shut off during periods of low flows, they would realize a need for a new water supply.

Adjudication of Indian water rights is also needed as input into sizing the canal. At this time, an estimate is used in the Three Phase Plan and the Tribe has not officially recognized our estimate.

To complete and process a planning report/environmental statement on Phase Three requires acceptance of the assumptions used in the study from all participants. There is no commitment from the junior water users or the Fort Belknap Indian Tribe on the assumptions. Therefore, the study is being concluded.

CENTRALIZED SERVICES DIVISION

CONSERVATION & RESOURCE DEVELOPMENT DIVISION (406) 444-6667

ENERGY DIVISION

OIL AND GAS DIVISION (406) 444-6675

WATER RESOURCES DIVISION

			The Milk River Basin has been unadjudicated with unresolved Indian Water Rights since irrigation first began there. This has not prevented effective water resource development in the basin and should not do so now. USBR's project is clear evidence that development can go on in this environment. Furthermore, the hydrologic model developed by USBR and DNRC to simulate the Milk River Basin is constructed so as to be able to estimate water shortages among each water user group (including junior and project users and the Fort Belknap Reservation) before and after adjudication. Consequently, we can quantify shortages to junior water users and demonstrate the need for Phase 3--a need junior water users already seem to have recognized.	
5-6	last	2	Table S-1 indicates canal top width is 42 feet yet the text here says 40 feet. Make consistent.	Corrected.
5-8			Phase 3 is formulated to provide water to the water users listed <u>except</u> Districts and Contract Pumpers. The 103,000 acres listed as benefitting from Phase 3 should be deleted.	The 103,000-acre figure has been deleted from the Phase 3 column of Table 5-2 as you suggest.
1-1	2	1	No frontispiece arrived with my advanced copy.	A location map has been added before the summary.
2-3	2	last	Insert "for" between "anticipated" and "at".	Corrected.
2-5	1	2	Insert "is" between "quantity" and "unknown".	Corrected.
2-5	1	1	A colon should follow "shortages".	Corrected.
2-5	1	5	Item 2. should read "The tribes would be entitled to all natural flow of the Milk River and tributaries upstream of <u>or passing through</u> the reservation and" . . . etc.	Sentence changed to read as you suggest.

2-7	2	1	Insert "average of" between "estimated" and "13,000 acre-feet".	Corrected.
2-8	1	1	Delete "province" and insert "scope".	No, province is correct.
2-8	2	2	Sentence should read "natural flow of the river which is inadequate to meet the water needs of senior water right holders as well as those of junior water right holders.	The sentence has been revised.
3-4	2	3	Delete the "of" between "because" and "the landowners. . ."	Corrected.
3-4	2	4	Delete "have" between "or" and "drain".	The sentence has been revised as you suggest.
3-5	Table		Arable lands for private and reservation users exceed those described in the summary (approximately 3,300 acres each). Some description reconciling these two values is needed.	Page 3-5 shows the acres classified by the soils investigations; Table 5-8 shows the acres proposed for irrigation. Explanation has been added to page 3-4.
3-9			Add a 4.1 to the left of the dotted line so it is clear how much of the overall deficit is due to facility and supply shortages.	The figure has been changed as suggested.
4-1	2	last	Insert "Board" between "Joint" and "of Control".	Corrected.
4-2	5	2	As I understand it, irrigator's willingness to pay (approximately $5/ac/yr) would only be sufficient to pay for the first element (R&B) of Phase II. If USBR is preparing reports for the Malta and Glasgow and the improvements contemplated in these reports will be repaid by the irrigaters, how can the reports cover all three elements of Phase 2?	The paragraph has been revised to eliminate the question.
4-4	3	2	Sentence should read "flow of the Milk River at its Eastern Crossing of the Canada-U. S. border is . . ."	The sentence has been revised to read ". . . eastern crossing of the border."

4-5	5	last	Replace "(see "References")" with a more conventional and specific reference such an "(USBR, 1987a)" or similar.
4-5	last	3	Change "PFWD" to "this report" or similar.
4-6	1	1	Add "and Dodson Pump Unit" after "and Chinook Divisions" for consistent reference.
4-9	2	2	Add "on" between "based" and "priority".
4-9	4	2	"an" should be "any".
4-31	Table 4-4		"Virgille" should be "Virgelle". Why was the period 1936 through 1985 used?
4-34	2		Please send a coy of the reference pertaining to seepage.
4-39	5	1	"Intrest" should be "Interest"
4-55	Footnote 10		37,000,000 x $3,023 is not equal to $112,000. Correct the incorrect values here.
4-63			Page 4-63 appears twice in my copy.
5-1	4	5	According to Table 4.10 net benefits of the NED plan are $787,000 not $1,610,000 listed here.
5-3	2	2	Sentence should read ". . .water users served by the 175 cfs x Canal Alternative, the Rocky Boys Reservation and private canal side irrigators. . ."
5-3	4	3	There is no "cost sharing" section in Chapter 5.
5-10	3		Add a sentence describing the amount which would be funded by a nonfederal entity ($10.1 M) after deferral of charges for Rocky Boys.

Rather than list the separate reports, we have chosen to simply refer readers to the References section.

This change has been made as suggested.

The change has been made as suggested.

Corrected.

The "an" has been dropped.

The table has been corrected:the 1936-85 period was used because 1936 was the earliest full year records were available for Virgelle, and 1985 was the last year considered in the 1986 study.

A copy of the Report on Canal Seepage: Milk River Water Supply Study will be mailed to you. The report is also included in the Hydrology Appendix.

Corrected.

The correct equation should be $37,000,000 x $3,023/$1,000,000 = $111,851 (rounded to $112,000).

Several pages were duplicated in the advance copy. These pages have been removed.

The figure on page 5-1 has been corrected.

The sentence has been revised as suggested.

See page 5-10.

A sentence has been added to page 5-10 to the effect that a non-federal entity would have to fund the $10,000,000 for private canalside lands.

A-13	4	1	Write out P&G at least once.
A-15	2	3	"ben" should be "been"
2-3,4			Ms. Marcia Rundle, Program Manager and Legal Council fer the Reserved Rights Compact Commission, has suggested alternate language describing Indian water rights. A copy of a memo with her suggestions is enclosed.
4-39,40			Text (page 39 indicates the economic cost of power is 22.2 mils/kwhr. Footnote 4 on page 40 indicates a power cost of 19.7 mils/kwhr. Why the difference? What is the source of these values?
A-15			There is a large unnecessary gap at the page bottom here. Continue text from A-20 and delete the gap.
A-20	Table		Why are there 2 categories of crop yields? What is the source of these values?
A-23			Why is the cost of alfalfa seed $235.00 per cwt in the prices paid section but only $107.00 per cwt in the prices received section?
A-24,25			A more thorough explanation of the negative net farm incomes is warranted. Explaining these as a function of the "internal workings" of the farm budget analysis does little to justify these values. The farm budgets themselves should be included.

Thank you again for the opportunity to comment on the report. If you have any questions regarding our comments, we would be pleased to discuss them with you.

Sincerely,

Larry Cawlfield, Hydrologist
Water Management Bureau

...ple ...uide... has ...dde... ...e / ...d th... ...rs referred to the References section.

Corrected.

Your memorandum has replaced pages 2-3 and 2-4 as suggested.

The text on page 4-39 refers to the opportunity cost of power (22.2 mills per kWh). Footnote 4 on Table 4.6 (page 4-40) refers to the actual cost of power (19.7 mills per kWh).

Rather than repaginate this section, we prefer to leave it as is.

Benefit yields are after the project is in operation; repayment yields are before the project is in operation. This explanation has been added to page A-20.

The higher price is for seed that has been cleaned, milled, fanned, etc.

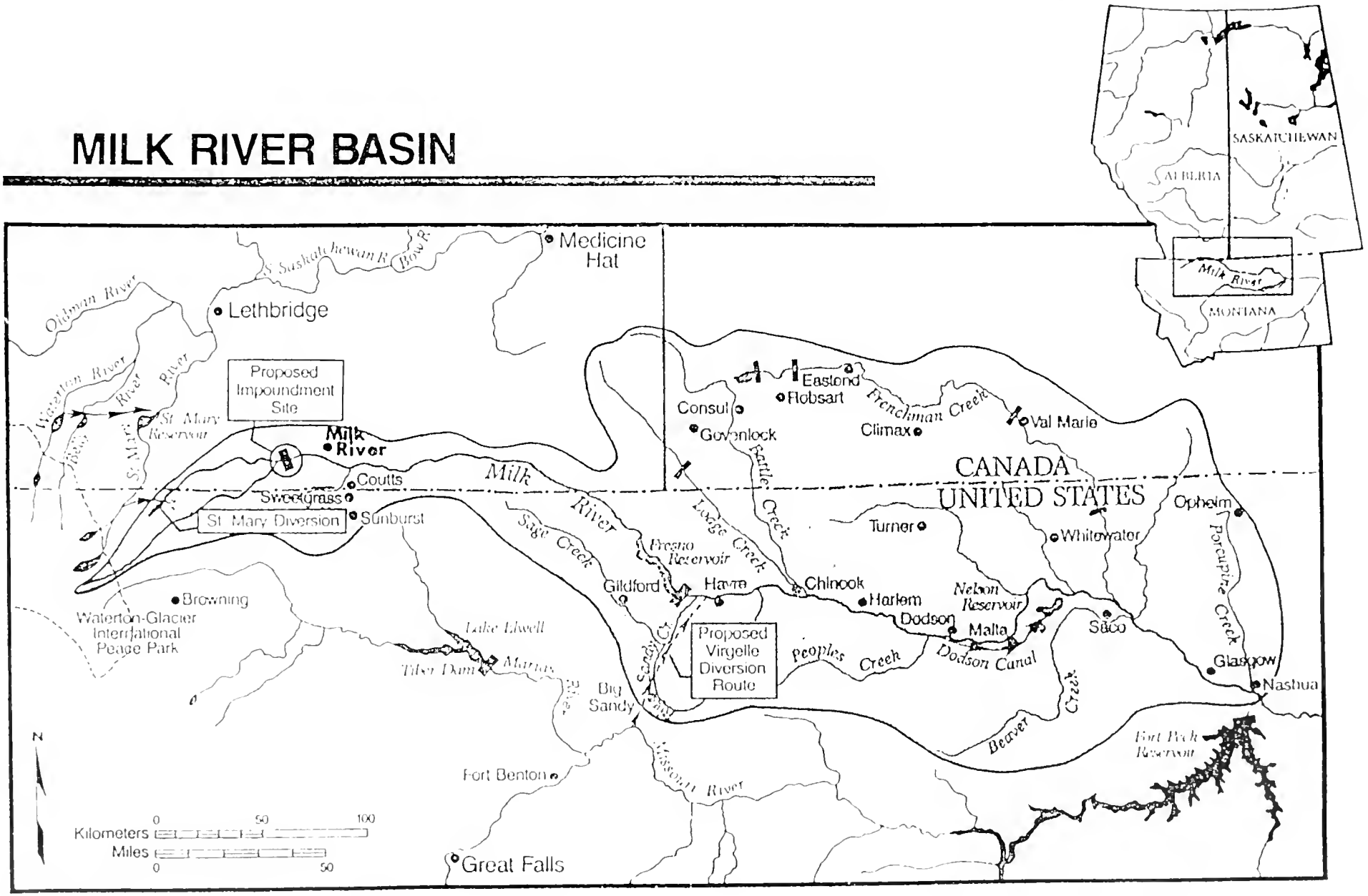
The paragraph has been dropped. Farm budgets can be found in the Economic Appendix. A note to this effect has been added to page A-24.

MILK RIVER WATER SUPPLY STUDY

REVISED

PLAN FORMULATION WORKING DOCUMENT

MILK RIVER BASIN



Source: 49th Parallel Institute

SUMMARY

Background

Irrigation in the Milk River Basin began during the 1880's by small individual systems, then developed into a community system with the construction of a diversion dam at the Fort Belknap Diversion site in 1890. Water shortages soon occurred. In the early 1900's, the Bureau of Reclamation constructed a storage facility (Lake Sherburne) on St. Mary River and a canal from St. Mary River to the North Fork of the Milk River to supplement Milk River flow. Nelson Reservoir, an offstream regulating facility, was added to the system in 1922. After the drought of the 1930's, Fresno Reservoir was constructed to provide more storage and to provide better management of the water diverted from St. Mary River.

There are now over 138,000 irrigated acres in the Milk River Basin. These include 92,000 acres within the Milk River Project, 11,000 acres which are irrigated under individual contracts with the Bureau, 10,425 acres on the Fort Belknap Reservation, and 25,000 acres of land being irrigated under a water right junior to all others.

Problems Today and Tomorrow

Today, Milk River irrigators face significant water shortages in 6 years out of 10. Recent examples of shortages occurred in 1983 and 1985 when the basin experienced diversion shortages of more than 35 percent. In 1984 the water supply was less than one-half of the annual diversion requirement. The average annual shortage is 122,600 acre-feet or 20 percent of diversion requirement. These shortages are caused by a combination of periodic severe droughts, overdevelopment of irrigation relative to the water supply, and aging canals that are unable to carry enough water demands of current irrigation operations.

Unfortunately, today's shortages will increase about 28,000 acre-feet in the future when Canada and tribes on the Fort Belknap Reservation make use of their legal share of Milk River waters.

About 200 miles of the Milk River cross the province of Alberta, Canada. Over the years, Alberta has not used its full share of Milk River water, allowing it to be used by Montanans downstream. Now Alberta proposes to build a dam to provide water for irrigation in Canada. When Alberta uses its full share of water, average annual water shortages of Montana irrigators would increase by about 15,000 acre-feet.

The Gros Ventre-Assiniboine Tribes on the Fort Belknap Reservation are negotiating their reserved water right. If the Tribes were granted a right to all the natural flow of the mainstem and tributaries of the Milk River upstream or rising on the reservation, the average shortage of other basin irrigators would be increased about 13,000 acre-feet. It was assumed for this study that a total of 24,000 acres would be irrigated on the reservation. This assumption was based on the number of acres which could be served by the existing Fort Belknap Diversion Dam. Study results show that in addition to their senior reserved water right, the Tribes on Fort Belknap Reservation will require a supplemental water supply to provide a full supply to 24,000 acres.

Water rights on the Milk River are presently being adjudicated by the State of Montana. Upon completion of the adjudication, distribution of water shortages in the basin should change. In the past, some landowners with junior water rights have diverted Milk River water during periods when the water supply was only adequate for landowners with senior water rights. When water rights are adjudicated and enforced, those with junior water rights will be forced to cease or reduce diversion when water supplies are limited. They will bear a much larger share of the shortages than they have in the past.

In addition to the irrigation water needs, about 7,500 acre-feet of exchange water is needed to allow the Bureau of Land Management to develop stockwater ponds on the tributaries of the Milk River. About 16,000 acre-feet of water is needed to improve waterfowl production at the Bowdoin National Wildlife Refuge and additional municipal water is needed for the town of Chinook.

Solutions to the Problem

The Milk River irrigators have been working with Reclamation and Montana Department of Natural Resources and Conservation (DNRC) to find a solution to the persistent shortages. A plan in three phases has been formulated, involving basin-wide management of the water supply available; rehabilitation of the aging canals, laterals, and onfarm systems; and a new source of water.

Phase 1

Phase 1 has already begun. A joint board of control is being established by the Milk River irrigators. This board will coordinate and consolidate basin-wide irrigation operation for more efficient and effective use of water, equipment, and district staff.

The irrigation districts are also restoring the St. Mary Canal to its original design capacity of 850 ft^3/s; present capacity is estimated at 700 ft^3/s. The diversion from St. Mary River via the St. Mary Canal provides a substantial amount of the water supply available to the Milk River irrigators. Restoring the canal will reduce the average annual shortages by an estimated 16,000 acre-feet (see Figure S-1).

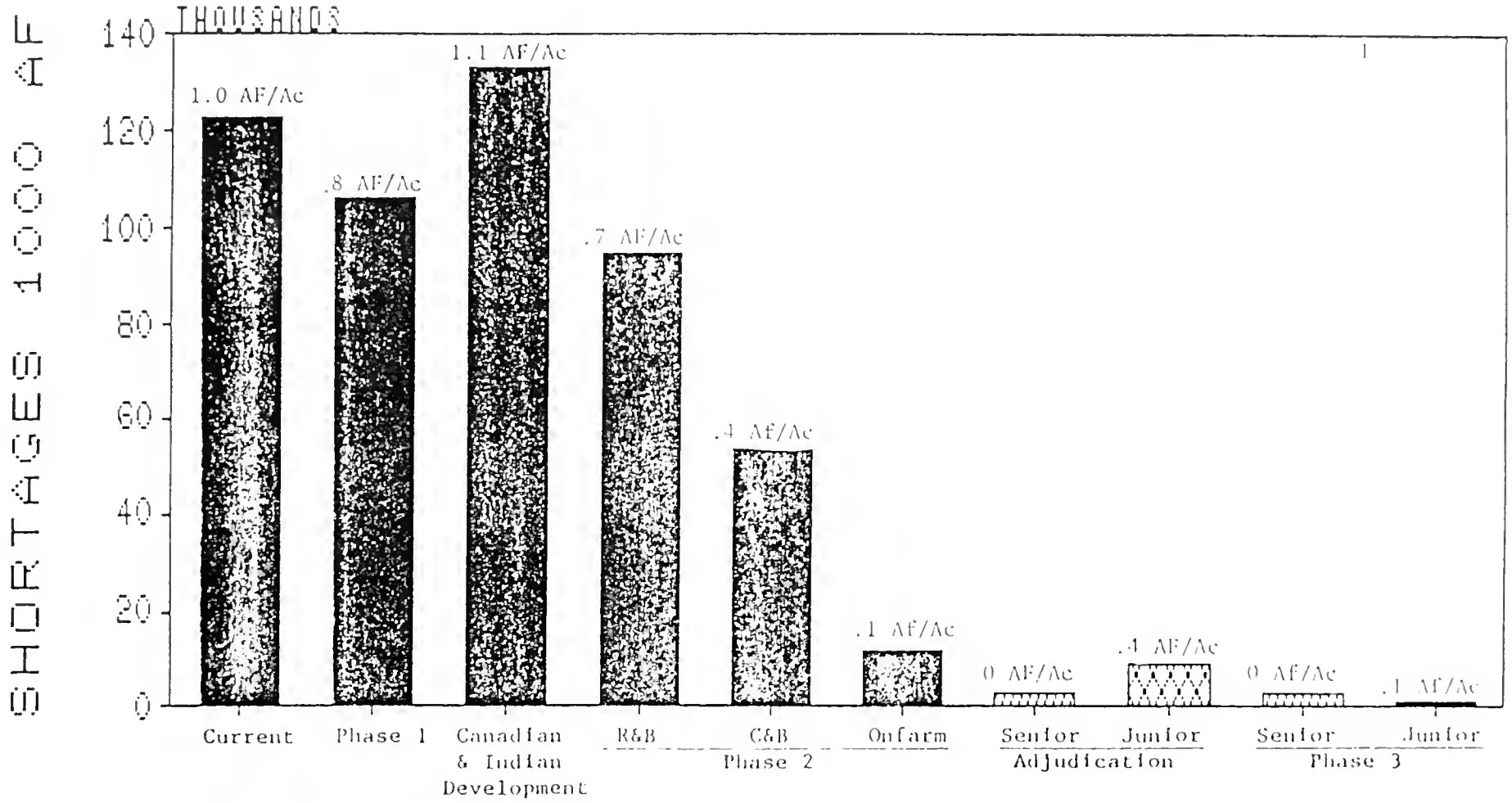
Phase 2

Phase 2 is tailored for the Milk River irrigation districts and contract pumpers, its main beneficiaries. Phase 2 will reduce water demands at canal headgates by improving conveyance efficiencies, through rehabilitation of the canals and laterals, and by increasing onfarm irrigation efficiency. Canals would then have enough capacity to meet crop irrigation demands. Phase 2 will also: (1) restore the reliability of the system, (2) provide measuring devices for the equitable and efficient distribution of water, (3) provide safety features for protection of human life, (4) restore design capacity to the system, thus reducing the risk of system failure, (5) permit reclamation of agricultural lands affected by canal seepage,

FIGURE S-1

WATER SUPPLY AND FACILITY SHORTAGES

AVERAGE



(6) improve annual operation and maintenance, and (7) ensure the continued social and economic welfare of the area. Without rehabilitation, water shortages will continue, and some of the larger facilities in the system will inevitably fail.

Specifically, Phase 2 includes three programs--Rehabilitation and Betterment, Construction and Rehabilitation, and Onfarm Efficiency Improvement. Rehabilitation and Betterment concentrates on project features requiring immediate action, including lining laterals with slip-form concrete or placing them in pipe; lining sections of main canals with compacted earth or membrane lining; repairing or replacing canal structures; realigning, deepening and rehabilitating open drains, building new drains, and installing measuring devices.

Construction and Rehabilitation will rehabilitate a major portion of the entire system. Obsolete structures like the Dodson Diversion Dam and Fort Belknap Diversion Dam will be replaced or modified, automated slide gates will be installed on several canals, canals will be reshaped and lined to conserve water and improve delivery efficiency, gravel service roads along the waterways will be built to provide better access for operation and maintenance, and drain works will be improved. Measuring devices will be installed on all farm turnouts and laterals.

The Onfarm Efficiency Improvement program contains two parts: inauguration of a basin-wide irrigation management system, and a program of onfarm improvements and operational changes to increase the irrigation efficiency by 15 percent. Onfarm improvements include field leveling, border dikes, gated pipes, concrete-lined head ditches, automated controls on head ditches, and sprinklers. The total cost of Phase 2 is $101,200,000.

Phase 2 will favorably affect the aquatic resources of the area: the flows in the Milk River will be higher during dry periods, and reservoirs will be held at higher levels. Some habitat for terrestrial species will be eliminated in seeped areas along canals and laterals. Other areas will be managed for wildlife in mitigation along Beaver Creek (2,755 acres),

Nelson Reservoir (1,340), Dodson Canal (558), Vandalia Diversion Dam (400 acres) and Lonesome Lake (5,600 acres).

Table S-1 lists features of Phase 2, and Table S-2 costs and benefits.

Phase 3

The irrigation districts and contract pumpers would have a full water supply after implementation of Phase 2 and enforcement of adjudicated water rights. Phase 3 was formulated to provide an adequate water supply to the landowners with junior water rights, Gros Ventre-Assiniboine Tribes on the Fort Belknap Reservation, Bureau of Land Management stockwater ponds, Bowdoin National Wildlife Refuge, and the town of Chinook.

The Preferred Plan for Phase 3 is the Virgelle-Milk 230 ft^3/s Canal Alternative. The pumping plant would be upstream of Boggs Island on the Missouri River (see Figure 4.3 in Chapter 4). An infiltration gallery design is proposed for the pumping plant. A plot would be excavated from the bottom of the river bed and filled with gravel. Well screens would be laid horizontally in the gravel bed. Water would be drawn through this gravel filter and pumped into a discharge line to the canal. This design would avoid impacts on the fishery, reduce transport of weed seeds, and reduce effects on the visual resources of the Missouri Wild and Scenic River.

Electric transmission facilities would probably be provided by a 69-kilovolt line from a substation at the town of Big Sandy to the pumping plant.

The canal would follow the Burlington Northern Railroad line right-of-way most of the way from the Missouri River to the Milk River. The canal would be about 12 feet wide at the bottom, 42 feet at the top, and 7 -feet deep. A total of 35 canal crossings would be built along the 46-mile canal route to provide access to adjacent landowners. Table S-1 lists features of the Preferred Plan, while costs and benefits can be found on Table S-2.

Table S-1: Features of Phases 2 and 3 (Preferred Plan)

Feature	Phase 2 Conservation & Rehabilitation (Future Without Condition)	Phase 3 230 ft^3/s Canal (Preferred Plan)
Rehabilitation Program	Line canals and laterals or place in pipe	---
	Repair or replace canal structures	---
	Rehabilitate drains and construct new drains	---
	Install measuring devices	---
	Replace Dodson Diversion Dam	---
	Modify Fort Belknap Diversion Dam	---
	Improve Onfarm Systems and Operation	---
Pumping Plant - Infiltration gallery design		
Capacity		230 ft^3/s
Total dynamic head		220 feet
Infiltration Gallery Bed		660' x 310'
Discharge line		
Length		3,000 feet
Diameter		66 inches
Intake Approach Velocity		.02 ft/s
Canal		
Capacity		230 ft^3/s
Length		46 miles
Canal Crossings		35
Dimensions		
Width at Bottom		12 feet
Width at Top		42 feet
Depth		7 feet
Canalside Feature		Distribution and Drainage System
Drainage System for Junior Water Right Acres along Milk River	-----	650 miles Drainage
System for Contract Pumpers	540 miles	---
Mitigation	Manage areas along Beaver Creek, Nelson Reservoir, Dodson South Canal and Lonesome Lake	Convert cropland to rangeland on ROW and manage areas around Lonesome Lake

Table S-2: Costs and Benefits of Phases 2 and 3 (Preferred Plan)

	Phase 2 Conservation & Rehabilitation (Future Without Condition)		Phase 3 230 ft^3/s Canal (Preferred Plan)
Benefiting Acres			
Districts and Contract Pumpers	103,000 acres		—
Junior Water Right Acres	—		25,000 acres
Fort Belknap Indian Reservation	—		24,425 acres
Bureau of Land Management	—		7,500 acre-feet
Municipalities	—		200 acre-feet
Rocky Boy Reservation	—		3,300 acres
Private Canalside Irrigation	—		3,243 acres
Bowdoin National Wildlife Refuge			15,700 acres
Construction Costs (January 1987 price levels)			
Rehabilitation and Betterment	$ 14,200,000		—
Construction and Rehabilitation	68,400,000		—
Onfarm Efficiency Improvement	18,600,000		—
Pumping Plant and Canal	—		44,000,000
Canalside Distribution	—		8,500,000
Canalside Drainage	—		7,300,000
Drainage for Lands Irrigated with Junior Water Rights			28,000,000
TOTAL	$101,200,000	(Rounded)	$88,000,000
Annual Economic Costs			
Construction	NA		$ 4,529,000
Drainage	NA		844,000
Interest During Construction (8-5/8%)	NA		399,000
Opportunity Cost of Energy	NA		333,000
OM&R (including energy)	NA		313,000
TOTAL ANNUAL ECONOMIC COST		(Rounded)	$ 6,418,000
Annual Benefits			
Irrigation	NA		$ 5,879,000
U.S. Fish and Wildlife (Lake Bowdoin)	NA		122,000
BLM Stockponds	NA		72,000
Unemployment	NA		159,000
Regional Benefits	NA		37,000
TOTAL Annual Benefit			$ 6,269,000
Net Annual Benefit			- $ 149,000
B/C Ratio			.98

Repayment	Payment Over 30 Years	Payment Over 40 Years
U.S. Fish & Wildlife Service	—	Nonreimbursable
BLM	—	Nonreimbursable
Junior Water Right Landowners	—	$11.55/acre
Fort Belknap Reservation	—	Deferred
Canalside		
Private	—	OM&R costs beyond ability to pay paid by non-Federal entity
Rocky Boy's	—	Deferred
M&I	—	Nonreimbursable

Lands in the Big Sandy area presently dryland farmed could be irrigated from the canal. This includes about 3,300 acres on Rocky Boys Reservation and 3,245 acres privately owned. Project costs include distribution and drainage systems for these lands.

The total cost for Phase 3 is $88,000,000 (see the Table S-2 above). Costs exceed benefits by a ratio of 0.98:1.0. The major environmental and social concerns are effects on wildlife habitat, on fisheries in the Missouri and Milk Rivers, seepage along the proposed Virgelle-Milk Canal, spread of weeds in the canal area, and severance of farmlands along the canal route.

The effect on the environment was determined to be insignificant. (Table S-3 presents the environmental effects in detail.) About 16,000 acre-feet of water would be provided to Bowdoin National Wildlife Refuge. Wetland habitat in the refuge has been destroyed by salts due to an inadequate water supply. This firm water supply will restore waterfowl production to normal levels and freshen degraded wetlands.

About 300 acres of native rangeland would be affected by construction of the Virgelle-Milk Canal. These impacts would be mitigated for by reseeding the right-of-way (ROW). Irrigation of canalside lands would cause the loss of another 1,300 acres of native range. A tentative mitigation recommendation is to manage part of the Lonesome Lake area for wildlife. (The Federal Government owns about 14,000 acres around the lake, so no land need be acquired.)

The infiltration gallery design would minimize the potential for affecting Missouri River fisheries as explained above. When flows in the Missouri were below the instream flow requirements, releases would be made from Tiber Reservoir into the Marias River (an upstream tributary) to replace project diversions. The flows in the Milk River will not change significantly, so the fishery would not be adversely affected.

One of the main concerns of the residents along the canal route is that a canal would increase seeps occurring in this dryland area (Table S-4 shows

Table S-3:
Environmental Impacts of Phases 2 and 3

Environmental Factor:	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	Phase 3 - Virgelle-Milk River Canal Alternative: 230 ft³/s Canal (Preferred Plan)	Significance 2/	200 ft³/s Canal	Significance 2/	175 ft³/s Canal (NED Plan)	Significance 2/
Water									
Missouri River	Annual flow is 6,333,000 acre-feet.	Flows would continue as occur presently.	o	Project would withdraw up to 230 ft³/s during April through September, the effects of which would be unmeasurable most years. Instream flow requirements would be met.	o	Project would withdraw 200 ft³/s up to during April through September, the effects of which would be unmeasurable most years.	o	Project would withdraw 175 ft³/s up to during April through September, the effects of which would be unmeasurable most years.	o
Milk River	Average annual flow in Milk River is 267,150 acre-feet.	Inflow to Milk River will decrease 40,000 acre-feet if Canadian projects are developed. Restoration of St. Mary's Canal will increase flows an average of 16,000 acre-feet.	-	Supplemental (replacement) water from Missouri River, in conjunction with future w/o conditions will assure full water supply to irrigators and maintain or enhance fish and wildlife resources.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Marias River and Lake Elwell	Lake Elwell is operated primarily for flood control. Consequently, reservoir elevations, and river flows below Tiber Dam, fluctuate considerably.	Present conditions would continue.	o	Releases from Lake Elwell to replace instream flows in the Missouri River would increase reservoir fluctuations but should improve flows in the Lower Marias downstream of the dam in dry years.	+ + +	Same as under Preferred Plan.	+ + +	Same as under Preferred Plan.	+ + +
Bowdoin National Wildlife Refuge	Inadequate water supply to maintain adequate water levels and freshen ponds.	Excess water could be available more often for Lake Bowdoin (estimate 2,700 acre-feet annual).	+	Additional water in the Milk River could be used to benefit productivity of Bowdoin National Wildlife Refuge and freshen refuge.	+ + +	Same as under Preferred Plan.	+ + +	Same as under Preferred Plan.	+ + +
Surface Water Quality									
Trace Elements	Iron, nitrate, manganese, selenium concentrations greater than primary and secondary drinking water standards were found on scattered sample sites in glacial till and alluvium.	Same	o	Isolated sites with high concentrations would probably not seriously impair use of irrigation return flows. Irrigation of water-soluble concentrations would be further limited by land classification and by factors like drainage and slope, which would eliminate most till lands from the project. Remaining lands would not cause significant increases in concentrations in return flows.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o

T[illegible] (Continued)

Environmental Factor:	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	230 ft^3/s Canal (Preferred Plan)	Significance 2/	Phase 3 - Virgelle-Milk River Canal Alternative: 200 ft^3/s Canal	Significance 2/	175 ft^3/s Canal (NED Plan)	Significance 2/
Pesticides	Analysis of five sites found all pesticide concentrations, except Picloram (Tordon), ranging from 1.0 ug/g of Trialiate at the Loredo dryland site, to 30.6 ug/g of Dicamba (Bandvel) at the Laredo irrigated site. All samples taken later (in October) below detection limits, showing pesticides do not persist in soil or drain water within a growing season.	Same	o	Same	o	Same	o	Same	o
Groundwater (Seepage)									
Milk River Basin	Existing irrigation facilities have seepage problems which, in turn, have caused the loss of agricultural productivity on the affected lands.	Rehabilitation of existing facilities and designs eliminating/reducing seepage from new facilities will return productivity to affected lands.	+	No change.	o	Same as under Preferred	o	Same as under Preferred	o
Fisheries									
Milk River	Classified as B-3. Fisheries resources are reduced during dry years because of low runoff, low releases from reservoir, and increased withdrawals for irrigation.	Biological assessment for the individual RAB and CAR projects concluded "no effect." An analysis regarding the cumulative effects concluded no effect.	o	Flows in river will be at higher level during dry years which should enhance fishery.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Missouri River	Same as Milk River.	No change.		Infiltration gallery design will minimize potential for impacting fisheries. Construction of gallery and pumping plant may disturb potential spawning areas during construction period.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o
Marias River	Classification is B-3 below Tiber Dam.	No change.	o	Releases from Tiber Dam would benefit fishery in Lower Marias.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Wildlife Habitat	Habitat had developed along the existing canal system and on some adjacent lands due to seepage.	Rehabilitation of existing facilities and construction of new, efficient ones will remove habitat that has developed. However, RAB and CAR projects incorporate mitigation areas to compensate for the losses.	o	Habitat losses that occur as a result of building the canal and irrigating canalside lands will be mitigated for within the canal ROW and by managing an area of Lonesome Lake. Enhancement potential exists at Lonesome Lake.	+	Habitat losses that occur as a result of building the canal will be mitigated for within the canal ROW.	o	Habitat losses that occur as a result of building the canal will be mitigated for within the canal ROW.	F

Table S-3 (Cont'd)

Environmental Factor	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	Phase 3 - Virgelle-Milk River Canal Alternative: 230 ft^3/s Canal (Preferred Plan)	Significance 2/	200 ft^3/s Canal	Significance 2/	175 ft^3/s Canal (NED Plan)	Significance 2/
Threatened/Endangered Species	Species that could occur in the area are: peregrine falcon, bald eagle, black-footed ferret, and piping plover.	Biological assessments for the individual R&B and CAR projects have concluded no effect. An analysis regarding the cumulative effect of these actions showed no effect.	o	No Effect.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o
Cultural Resources	There are known sites but the specifics are lacking.	Cultural resources survey and mitigation requirements have been accommodated for the individual R&B and CAR projects. Surveys will be taken where earth-disturbing activities are to take place.	o	Class III survey of canal route and adjacent lands completed. Cultural resources on access roads, borrow areas, construction staging areas, unplowed lands to be irrigated, and areas where the canal route changed from the 1995-96 survey will also be inventoried. Reclamation will consult with SHPO on eligibility of any finds and possible mitigation.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o
Weeds	Spotted knapweed and leafy spurge presently not known to occur on lands between Milk and Missouri Rivers.	These weeds will eventually invade these lands.	- -	Use of an infiltration gallery for pumping plant intake should prevent transport of seeds from Missouri River. Reclamation recommends a weed control board to assure that canal ROW is properly managed.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o

1/ The Future W/O Project Condition (Phase 2) assumes that the proposed R&B and CAR projects in and along the Milk River will be in place along with improvements in on-farm irrigation efficiency, prior to building the canal. The cumulative effects of this scenario regarding threatened/endangered species, and fish and wildlife resources, is presently being evaluated.

2/
- \- Minor adverse
- \- - Moderate adverse
- \- - - Highly adverse
- o No significant effect
- \+ + + Highly beneficial
- \+ + Moderately beneficial
- \+ Slightly beneficial

the social effects). The canal would be lined with membrane lining to ensure that seeped areas would not increase.

Another concern of Big Sandy residents is the transport of weeds. The infiltration gallery design pumping plant would also avoid weed transport. Reclamation further recommends that a weed control board be established with representation from the Milk River Irrigation Districts and Big Sandy area to ensure that the canal ROW is maintained adequately.

The route selected for the canal lessens the impact on adjacent landowners by following the railroad ROW, which has been abandoned along half the route. Crossings have been included to provide access.

A Class III cultural resource survey of the canal route ROW found 14 prehistoric and historic sites. Three are considered eligible or potentially eligible for the National Register of Historic Places. Of primary concern is the Great Northern Railroad and associated features determined eligible as a National Historic District. Other potentially eligible sites include prehistoric stone circles with rock cairns and artifact scatters. Each site would be evaluated, and determinations of effects made in conjunction with the Montana State Historic Preservation Officer. Project effects on sites determined eligible for the National Register would follow 36 CFR Part 800.

Canadian Reservoir

As discussed earlier, Canada may build a reservoir on the Milk River. Milk River irrigators may be able to lease storage in this reservoir. The irrigators and DNRC are discussing a potential leasing arrangement with Alberta Environment. If the reservoir is built, leasing storage could obviate the need for the Virgelle-Milk Canal. The planning of the reservoir is a matter for the Province of Alberta.

Studies for Phase 3 focused only on selecting the best plan for the canal. Appropriate documents (including NEPA compliance) were prepared for Phase 1 and 2 by the responsible parties.

Table S-4:
Comparison of Social Accounts

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal 230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Farms Crossed (By Canal)	The Big Sandy area is presently dryland farmed.	No change in Big Sandy area.	19 farms crossed by canal - 35 bridges provided, averaging about 1-mile intervals.	Same as Preferred Plan.	Same as Preferred Plan.
Weed Spread	Spotted knapweed and leafy spurge not known to occur along canal route.	No change in Big Sandy area.	Potential for weed spread, controlled by infiltration design pump, and weed control programs.	Essentially same as Preferred Plan.	Essentially same as Preferred Plan.
Seepage from Canal	Saline seeps occur in Big Sandy area.	No change in Big Sandy area.	Seepage from canal controlled by canal lining and toe drains.	Essentially same as Preferred Plan.	Essentially same as Preferred Plan.
Population	Rural area. Historical trend of rural population decline.	Overall population increase of about 10 percent by year 2000. Historical trend of rural population decline will continue. 1/ Increase of 100 people during 10-year construction period. Slight decrease in rate of long-term rural population loss.	Construction period population increase of 290 people, mostly in Hill and Choteau Counties. Slight decrease in rate of long-term rural population loss.	Same as Preferred Plan, except increase of 260 people during construction.	Same as Preferred Plan, except increase of 230 people during construction.
Employment	Historical trends of increases in urban and decline in rural areas. High unemployment on Rocky Boy's and Fort Belknap Reservations.	Continuation of historical trends. Unemployment on reservations will remain high. Annual direct onsite employment of 50 jobs during 10-year construction period.	Direct onsite employment during construction of 180 jobs, 70 available to Rocky Boy's and Fort Belknap Reservations. Increase of 45 agricultural jobs.	Onsite employment of 160 jobs, 60 available to reservations. Increase of 40 agricultural jobs.	Onsite employment of 140 jobs, 50 available to reservations. Increase of 40 agricultural jobs.

1/ Source: 1980 OBERS Regional Projections, U.S. Department of Commerce.

Table S-4 (cont'd)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal		
			230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Income (During Construction and Annual Agricultural Income)	Area is dependent upon agricultural base which is stabilized by irrigation. Per capita income below national average. Annual average water shortages of over 20 percent will continue to have an adverse impact on income.	Per capita income will remain below national average. Current dollar income will increase by 60 percent by year 2000, but ag sector by only 35 percent. 1/ Earnings during construction would be about $2.7 million. Indirect regional earnings of about $2 million. Average increased annual direct and indirect agricultural income of $8.5 million.	Direct earnings during construction would be about $6.8 million, about $2.7 million of which would accrue to Tribes. Average annual increased direct and indirect agricultural income of $8.2 million, $2.2 million of which would accrue to Tribes.	Similar to Preferred Plan, except construction earnings of $5.9 million, with about $2.3 million accruing to Tribe. Average annual increased direct and indirect agricultural income of $7.6 million; with about $2.2 million accruing to Tribes.	Similar to Preferred Plan, except construction earnings of $4.8 million, with about $1.9 million accruing to the Tribe. Average annual increased direct and indirect agricultural income of $6.9 million, with about $2.2 million accruing to Tribes.
Housing	As of 1980, housing vacancy rate of 15 percent within five counties comprising Milk River Water Supply Study service lands and canal area. Current and future rates should be comparable due to depreased rural economics.	About 20 additional housing units required during construction. Could be accommodated in project area without undue stress.	About 60 additional housing units required during construction.	Same as Preferred Plan, except 55 units required.	Same as Preferred Plan, except 50 units required.
Facilities and Services	Area typical of rural areas in the State, in which provision of social and medical services difficult due to distances traveled.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 30 additional students.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 100 additional students.	Similar to Preferred Plan, except 90 additional students would be accommodated.	Similar to Preferred Plan, except 80 additional students wold be accommodated.

Table S-4 (cont'd)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal		
			230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Annual Cost (Annual Equivalent Economic Cost)	N/A	Annual costs of $8.7 million.	Annual costs of $6.4 million.	Annual costs of $5.5 million.	Annual costs of $4.5 million.
Indian Lands (Acres irrigated)	N/A	N/A	13,150 acres of land irrigated on Fort Belknap and Rocky Boy's Reservations.	Same as Preferred Plan.	9,750 acres of land irrigated on Fort Belknap Reservation.

Implementation

The Milk River irrigation districts are implementing Phase 1 of the plan. Restoration of St. Mary Canal will be complete in 1991.

Phase 2 is being completed under Reclamation's "Rehabilitation and Betterment" (R&B) Program. Reclamation is completing R&B studies for the Malta and Glasgow Divisions. While the Montana Department of Natural Resources and Conservation is completing similar studies for the Chinook Division and Dodson Pumping Unit. The R&B Program for Malta and Glasgow Divisions could also be funded as part of the R&B Program.

The R&B study for Chinook and the Dodson Pumping Unit could be funded under Reclamation's Small Projects Loan Program or from a State of Montana program.

While implementation of the R&B phase of this plan would provide a partial solution to the water shortages in the basin, Milk River irrigators, Reclamation, and the State are seeking a complete solution. It is thus proposed that the three-phased plan be authorized as part of the Pick-Sloan Missouri Basin Program (P-S MBP). Phase 1 (creation of Joint Board of Control and restoration of St. Mary Canal) should be completed and funded by the project sponsors. Phase 2 would be completed under the Rehabilitation and Betterment Program and integrated into the P-S MBP. Phase 3 would be planned and constructed by Reclamation and integrated into the P-S MBP.

CHAPTER 1: INTRODUCTION

PURPOSE AND SCOPE

The water users in the Milk River Basin experience severe water shortages. The purpose of this study is to determine the best way to alleviate these shortages. The preferred plan is a combination of water conservation, improved water management, and an increased water supply.

LOCATION AND SETTING

The Milk River rises east of the Continental Divide at the confluence of three streams on the Blackfeet Reservation, flowing 216 miles through the Province of Alberta, then reentering the United States in Hill County, after which it flows another 490 river miles to its confluence with the Missouri River (see frontispiece). The Milk River drains an area of 23,300 square miles, of which 15,521 square miles are in the United States.

The climate of the basin is semiarid with hot summers and cold winters. The frost-free season varies, averaging about 126 days per year. Annual precipitation ranges from 12.5-14 inches. Approximately 50 percent of the precipitation occurs April-September.

Agriculture is the basis of the economy in the Milk River Basin. Over 138,000 acres are presently irrigated from the mainstem of the Milk River. Most of these acres are served by the Milk River Project, one of the earliest Federal irrigation projects. Facilities of the project include Lake Sherburne on the St. Mary River, St. Mary Canal which diverts water from St. Mary River to Milk River, Fresno Reservoir on the Milk River, and Nelson Reservoir, an offstream storage facility. The Milk River Project includes three divisions. The irrigation districts within each division and the diversion facilities and canals are as follows:

Division/District	Diversion Facility	Canals
Chinook Division		
Fort Belknap District	Fort Belknap Diversion Dam	Fort Belknap
Alfalfa Valley District	Fort Belknap Diversion Dam	Fort Belknap
Zurich District	Fort Belknap Diversion Dam	Fort Belknap
Paradise Valley District	Paradise Valley Diver. Dam	Paradise Valley
Harlem District	Two Pumping Plants	Harlem Canal
Malta Division		
Malta District	Dodson Diversion Dam	Dodson North Dodson South Nelson South
Dodson District	Dodson Diversion Dam	Dodson North
Glasgow Division		
Glasgow District	Vandalia Diversion Dam	Vandalia

Most irrigated lands are on the level floodplain and terraces in the valley, but some are located on rolling glacial uplands and on gently sloping alluvial fans deposited by tributary streams. Soils are typically medium-textured near the river, and finer-textured away from the river. Much of the floodplain is underlain by stratified alluvial deposits, while the gravelly well-developed soils of the glacial uplands are usually underlain by glacial till.

Several large seeps evidence drainage problems on the Milk River Project. Drainage is complicated by natural levees higher than farmland further from the river. The levees impede natural surface drainage, causing ponding and consequently complicating subsurface drainage.

Although irrigated agriculture is the predominant land use in the valley, riparian and other wildlife habitat is common in the area. The river's oxbows, sloughs and extensive canal systems support substantial riparian areas, with interspersed croplands providing excellent diversity. Seepage from many of the canals has allowed the creation of wetlands not present under natural conditions. Vegetation along the waterways is primarily a grass-forb mixture with occasional concentrations of rose, willow, buffaloberry and scattered cottonwood. Upland areas away from the river are largely rangeland and dryland cropland.

The Milk River Valley supports large numbers of waterfowl, game and nongame birds, mammals, reptiles and amphibians. Three wildlife species listed as endangered by the Federal Government could occur in the area: peregrine falcon, black-footed ferret and bald eagle. The piping plover is listed as threatened.

BLACKFEET RESERVATION WATER DEVELOPMENT POTENTIAL

The Blackfeet Reservation, located in Glacier and Pondera Counties, Montana, borders both Glacier National Park and Canada. To the extent that the headwaters of the Milk River lie within its boundaries, the reservation is associated with the Milk River Irrigation Project. Also, key project facilities used in the storage and transfer of St. Mary River water to the Milk Basin (St. Mary Canal and Sherburne Reservoir) are located on the reservation.

Recently the Blackfeet identified potential water development proposals that need to be integrated into the present study. These specific development proposals are currently in a conceptual stage and are presented as such in this document. The proposals are not expected to have a significant effect on the proposed program to resolve irrigation water shortages in the Milk River Basin. The Tribe will participate with the Department of Natural Resources and Conservation, the Milk River Irrigation District, and the Bureau of Reclamation in evaluation of the development proposals on the reservation as approved by the Tribal Council. Results on this evaluation would be presented in the Regional Director's Planning Report/Draft Environmental Statement.

A brief description of several water development options on the Blackfeet Reservation are presented below. The list is meant to be illustrative of the forms of development that will be considered and is not intended to be inclusive.

1. Storage in Lower St. Mary Lake -- The surface elevation of Lower St. Mary Lake, a natural body of water located on the reservation, could

raised 2 to 5 feet and thereby store an estimated 5,000 to 15,000 acre-feet of water. Since this water would come out of the U.S. share of St. Mary River flows, the project would necessitate a revision of the computational procedure for apportioning flows between the United States and Canada.

2. Instream flow in Swiftcurrent Creek -- Releases from Sherburne Dam on Swiftcurrent Creek flow into Lower St. Mary Lake and then to the St. Mary River where the diversion dam for the St. Mary Canal is located. During the irrigation season, the reservoir releases generally maintain an acceptable instream flow in Swiftcurrent Creek. Providing adequate instream flows in the off-season would require yearly storage releases of about 20,000 acre-feet. Since these stored flows would otherwise be diverted for use on the Milk River Irrigation Project, alternative developments would be needed to offset these losses.

3. Enlargement of Spider Coulee Lake -- Located on the St. Mary Canal, water diverted from the St. Mary Basin flows through Spider Coulee Lake. The dam creating this lake would be raised and, with a change in operation of the St. Mary Canal during April and May, the lake's storage capacity would increase in excess of 5,000 acre-feet.

4. Divert Kennedy Creek flows directly into the St. Mary Canal -- Kennedy Creek is the last major tributary to the St. Mary River between the diversion dam for the St. Mary Canal and the Canadian border. Currently, Kennedy Creek waters flow unused into Canada since a siphon for the St. Mary Canal is located under Kennedy Creek. Nonetheless, the creek has high flows in the spring that could be diverted into the canal and stored in an enlarged Spider Coulee Lake. An option would be to store spring flows in a reservoir on Kennedy Creek for later diversion during the irrigation season.

5. Irrigation Development in the Cutbank Creek Drainage -- Currently a contractor to the Bureau of Indian Affairs is conducting a soils classification study to delineate irrigable soils throughout the reservation. Lands in the Cutbank Creek drainage are among those being classified and several areas appear favorable for irrigation development. A water supply

needed to sustain such use would require a diversion from the St. Mary River into the St. Mary Canal and subsequently to a lateral that leads to the Cutbank Creek drainage. The development of reservoir storage in Cutbank Creek would be an important aspect of this option. Crops to be irrigated, which largely include alfalfa, pasture, and feed grains, would be used to support an expanded livestock economy. This proposed plan is similar to an All-American Diversion plan that was studied in the 1940's. The All-American Diversion plan was to divert the United States' share of water from the Belly and Waterton Rivers in Glacier Park to a storage facility on the St. Mary River. The storage facility was located in the vicinity of Babb, Montana. Storage water would be diverted via a canal with regulatory reservoirs along the way to serve potential irrigation near Shelby, Montana, with return flows to the Marias River.

6. Power Development on Drops in the St. Mary Canal -- In 1985, a reconnaissance-level examination was made on the potential for small hydropower development on five drop structures along the St. Mary Canal route. An assumption used in this examination centered on the diversion of flows in the existing canal into a new canal with a capacity of 490 cubic feet per second. Located above the first drop structure, this new canal would divert flows for 2.8 miles to a 600-foot penstock with an elevation drop of 180 feet. Once used in the powerplant, the flows would return to the North Fork of the Milk River about one-half mile upstream of the point where the canal presently enters the river. Also, if the St. Mary Canal was modified to deliver water to the Cutbank Creek drainage, consideration would be given to installing a penstock for a future powerplant.

PREVIOUS STUDIES AND AUTHORITY

Water shortages in the Milk River Basin have been the subject of many studies. Since the early 1970's the Bureau of Reclamation (Reclamation) and the State of Montana have investigated plans for delivering additional water to the basin (Reclamation 1977, DNRC 1977). Although some of the early plans were shown to be economically feasible, no action was taken at that time.

At the request of the Milk River Irrigation District in 1984, the Montana Department of Natural Resources (DNRC) and Reclamation focused on plans to divert water from the Marias River to the Milk River. Although the Marias-Milk diversion was found to be economically infeasible, seven other alternatives were developed. These seven alternatives were evaluated as part of the present study.

In addition to this report, Reclamation is also making engineering and financial surveys for the complete rehabilitation of the Glasgow and Malta Irrigation Districts for inclusion in Reclamation's Rehabilitation and Betterment Program. The DNRC is completing a similar study for the Chinook Division and Dodson Pumping Unit. (These studies are described in more detail in Chapter 4.)

Investigations on the Marias-Milk Unit were authorized by Congress on September 7, 1966, (80 Stat. 707).

PUBLIC INVOLVEMENT

Public involvement for this study included these groups:

- Milk River irrigators who would benefit from the project
- Dryland farmers in the Big Sandy area whose land would be along a proposed canal route
- Chippewa-Cree Tribe on Rocky Boys Indian Reservation
- Gros Ventre-Assiniboine Tribes on the Fort Belknap Reservation
- Federal and State agencies

Reclamation representatives attended Milk River Irrigation District Board meetings periodically to keep the district up-to-date on the study.

Public meetings have been held in several communities to pass on information, answer questions, and receive comments. Scoping sessions were held to identify environmental issues. Several meetings have been held on the Rocky Boys and Fort Belknap Reservations to discuss the findings of the study as they pertain to interests of the tribes.

Details of the various meetings and the issues raised can be found in Chapter 6 "Consultation and Coordination."

CHAPTER 2: PROBLEMS AND NEEDS

This study addresses the water shortages in the Milk River Basin. The largest water user along the Milk River below Fresno Reservoir is the Milk River Project, including over 100,000 irrigable acres. Other water users include:

- the Fort Belknap Indian Reservation.

- irrigators with individual Reclamation contracts (contract pumpers).

- irrigators with water rights junior to the Milk River Project, and the Fort Belknap Reservation, and contract pumpers (junior water right landowners).

- Bowdoin National Wildlife Refuge.

- Bureau of Land Management stock ponds on tributaries.

- communities along the river.

- landowners with water rights senior to Reclamation's (537 acres).

Water shortages experienced by the different users vary. Accessibility to available water at present determines the shortage. When the Milk is adjudicated and a river commission appointed, shortages will be determined by the seniority of water rights. This chapter discusses the water rights and water shortages of each group. The alternatives in Chapter 4 were formulated to reduce the water shortages of all water users in the basin.

WATER RIGHTS

International

Allocation of water from the Milk and St. Mary Rivers is governed by the Boundary Waters Treaty of 1909. The treaty states that during the irrigation season (April 1 to October 31) the United States is entitled to three-fourths of the natural flow of the Milk River at the border (eastern-most crossing) when the natural flow is 666 ft^3/s or less. Flows over 666 ft^3/s are divided equally between the two countries. During the rest of the year, the natural flow at the eastern crossing is divided equally between the two countries. Water from the St. Mary River is divided similarly, but Canada receives its three-fourths share during the irrigation season. The water of the eastern and northside tributaries of the Milk (see the map at the front of this report) are split equally.

Montana

The first Milk River water right was filed in 1889. As part of the Milk River Project, Reclamation filed water rights in 1903 and 1908 on all unappropriated water of the Milk River and its tributaries, totaling 51,305 ft^3/s.

Reclamation contracted for the water rights in 1911 of nearly all prior appropriations in the lower Milk River Basin. Known as the Vested Water Right Contract, it included the water supplied to 26,177 irrigated acres or nearly all of the land irrigated in 1912. Under the terms of the contract, prior appropriators conveyed to Reclamation all rights to the water supply. Individual appropriators kept service rights to an additional 537 acres.

Between 1920-1926, seven of the present eight irrigation districts were organized. (The eighth, Dodson Irrigation District, was formed in 1944.) Reclamation issued 145 water-service contracts in excess of 1 acre-foot/acre between 1946-1967 for 11,000 acres along the Milk River mainstem. Contracts were issued to individual pumpers outside the irrigation

districts, limited to 2 acre-feet of water per acre. In 1967 all of the districts and the owners of the 11,000 acres under pump contract signed an equalization pact that gave an equal right to the water supply for the Milk River Project.

There are an additional 25,000 acres of land which are irrigated outside of the district boundaries, which are not irrigated by contract pumpers. Approximately 55 Montana water rights and use permits (totaling 8,800 acres) have been recorded along the Milk River (exclusive of the tributaries). Before 1973, 35 water rights for 6,700 acres were established. Twenty water use permits for 2,100 acres have been granted since 1973. All private water rights and permits are considered junior to Reclamation rights. The water right status of the remaining acreage irrigated outside the district boundaries (16,200 acres) is uncertain at present. Water rights in the basin are presently being adjudicated. Adjudication has been given top priority by the State, but completion is not anticipated for at least 10 years.

Under State law, DNRC closed sections of the Milk River in April 1983 to new water appropriations, covering the mainstem from the river's eastern crossing of the border to Vandalia Dam (between Malta and Glasgow) and applying to applications for direct diversions without storage. The river section between the eastern crossing and Fresno Dam is closed each year from January 1 to December 31, inclusive. Sections between Fresno Dam and Vandalia Dam are closed each year from June 15 to September 30, inclusive.

Indian

Water uses on the Fort Belknap, Blackfeet, and Rocky Boys Reservations are protected by unquantified Federal reserved water rights held by the Gros Ventre and Assiniboine, Blackfeet, and Chippewa-Cree Tribes. The Tribes on the Fort Belknap, Blackfeet, and Rocky Boys Reservations are negotiating with the Montana Reserved Water Rights Compact Commission to quantify reserved water rights, but no agreements have been concluded.

The 1908 Winters case which established the reserved water rights doctrine recognized a Federal water right for the Fort Belknap Tribes to use a minimum of 125 ft^3/s of the Milk River, with a priority date of 1888.

The reserved water right for the Blackfeet dates from the same 1888 agreement which created the Fort Belknap Reservation. The case which established the 1888 priority date for the Blackfeet Reservation recognized a water right for the Blackfeet to use a minimum of 33 1/3 ft^3/s of Birch Creek but provided for future modification if the water needs of the reservation changed. Although the water source decreed in that case is in the Missouri River basin, the priority date for the reservation is the same on all water sources.

The Chippewa-Cree Tribe on the Rocky Boys Reservation have claimed a reserved water right on Big Sandy Creek and the headwaters of Beaver Creek.

The Fort Peck Reservation also borders the Milk River. An agreement between the Assiniboine and Sioux Tribes and the Montana Reserved Water Rights Compact Commission excluded the Milk River as a source of the reserved water right of the Fort Peck Tribes.

IRRIGATION SHORTAGES

Shortages on the Fort Belknap Indian Reservation

The Gros-Ventre Assiniboine Tribes on the Fort Belknap Reservation presently irrigate about 10,425 acres, with a reserved water right under the Winter's Doctrine. The tribes reserved water right is being negotiated, but the quantity is unknown until negotiations are complete. The following assumptions were made to estimate the tribes' current and future shortages:

1. A total of 24,425 acres would be irrigated from the mainstem of the Milk River (10,425 existing acres and 14,000 new acres) under the reserved water right.

2. The tribes would be entitled to all natural flow of the Milk River and tributaries upstream of or passing through the reservation or passing through and one-seventh storage in Fresno Reservoir.

3. The tribes would continue to improve their existing irrigation system by conservation and a rehabilitation program. Funds for these programs are being provided through the Bureau of Indian Affairs.

Based on these assumptions, the average annual current shortage would be only 4 percent for the existing 10,425 acres. During an extremely dry year, however, the tribes could be short up to 60 percent. If the tribes developed 14,000 new acres under their reserved water right, it is estimated they would be short 11 percent on an average annual basis and up to 82 percent during an extremely dry year. The tribes, therefore, would need a supplemental water supply even with a senior reserved water right to provide a full water supply to a total of 24,425 acres.

Water Shortages of the Milk River Project (Districts and Contract Pumpers)

Milk River water shortages are critical to the well-being of the valley. Continual shortages place a burden on the livelihoods of the irrigation

districts and contract pumpers. Under current conditions, average annual shortages are 20 percent of the average annual demand. When evaluation over a 59-year period, the shortages exceed 10 percent of demand in 6 years out of every 10. While average annual values help illustrate the overall extent of water shortages, they do not show how severe shortages can be. In 1984, for instance, the water shortage exceeded 50 percent of the demand. (See Attachment 1 for more detail.)

Contributing to the shortage problem is the poor condition of the irrigation facilities. The Milk River Project was among the first irrigation projects constructed by the Bureau of Reclamation. Many of the 70-year-old facilities are obsolete or in serious need of repair. Modernization and improvement of project facilities would: (1) restore the reliability of the system; (2) conserve water by reducing seepage losses and operational wastes; (3) provide measuring devices for the equitable and efficient distribution of water; (4) provide safety features for protection of human life; (5) restore design capacity to the system to avoid overloading it, thus, reducing the risk of system failure; (6) reclaim agricultural lands affected by seepage losses; (7) improve annual operation and maintenance; and (8) improve social and economic welfare of the area.

Without rehabilitation, chronic water shortages will continue, and some of the larger features in the system will inevitably fail with severe consequencies. If the Dodson Diversion Dam failed during the irrigation season, for example, extensive crop loss could occur and emergency reconstruction costs would certainly be high.

Along with rehabilitation, improved management of the water supply is also needed in the Milk River Valley to ensure that water is distributed equitably among all eight irrigation districts. Water supplies may be adequate in one district, while other downstream districts may be experiencing severe shortages. Water management presently is hampered by:

1. Lack of measuring devices.

2. Lack of a Board of Control. The irrigation districts operate individually, with a board of directors meeting periodically to discuss problems which are common to all districts; e.g., water supply, operations, maintenance, and replacement (OM&R) charges.

3. An unreliable water supply.

4. Lack of incentive to use water efficiently.

5. Lack of capital for maintaining and updating onfarm irrigation systems. Present onfarm systems are estimated to be able to use only 27 percent of the water diverted for irrigation (SCS, 1987).

6. Unadjudicated water rights. After adjudication is completed, a river commission could be appointed to enforce water rights.

Current shortages of Milk River Project, contract pumpers, and landowners with junior water rights will increase by an average of 13,000 acre-feet per year when the development on the Fort Belknap Reservation takes place under the Tribes' reserved water right. In addition, Canada proposes to use its full legal share of the Milk River mainstem and tributaries. Canada proposes to build a reservoir on the Milk River and develop new irrigation. On an average basis, the United States receives 40,000 acre-feet per year of water beyond its share. Consumption of Canada's entire share will cause in an average annual increase in U.S. irrigation shortages of about 15,000 acre-feet (see Table 4.1).

Much of the excess Canadian water is passed during the spring runoff period of high water years. At these times, irrigation demands are low and storage in U.S. reservoirs generally filled. Therefore, at the time available, most of the extra Canadian water is not useful for irrigation and is simply passed down the Milk to its mouth. During drought years when U.S. water users experience severe irrigation shortages, Canada's share of water is small and mostly used by Canadian irrigators.

The DNRC and the irrigators are presently working with the Alberta government to see if irrigators can lease storage in the proposed Canadian reservoir. Because the planning for the Canadian reservoir is incomplete

and beyond the province of this report, leasing storage in the reservoir was not included as a possibility in this study.

Water Shortages of Landowners with Junior Water Rights

More than 25,000 acres of land are irrigated under water rights junior to that of the irrigation districts, contract pumpers, and Fort Belknap Reservation (see "Water Rights"). These landowners involved do not share in the cost of Milk River Project storage facilities, so they rely only on the natural flow of the river, even though it is inadequate most years to meet the requirements of senior rights holders. Because of the lack of adjudication of water rights, many of these junior water right holders divert water even when holders with senior water rights (the districts and Tribe) are short.

When adjudication is completed and water rights are enforced, however, these 25,000 acres will be extremely short of water. It is estimated the junior water rights holders would be short 100 percent in a dry year like 1984. Ten percent of the time junior water rights would be short 50 percent or more, and 60 percent of the time they would be short 10 percent or more. With such shortages, these lands would probably revert to dryland farming, unless a new water supply is developed.

Water Shortages of Bowdoin National Wildlife Refuge

The Bowdoin National Wildlife Refuge, 7 miles east of Malta, encompasses approximately 15,500 acres, including Lake Bowdoin (3,500 surface acres) and Dry Lake (1,300 surface acres). The refuge encompasses 6,500 acres of native grasslands, 200 acres of dense nesting cover, 100 acres of shelterbelts, 2,200 acres of mixed grass/shrub and 6,500 acres of wetlands. Soils in the vicinity are typically saline/sodic clays.

Lack of water to dilute salt concentrations by periodic flushing or flow-through water management has resulted in an accummulation of salts in Lake Bowdoin and Dry Lake. These salt concentrations have destroyed

wetland habitat; cattails and round bulrushes have been replaced by alkali-tolerant species. Submerged plants such as pondweeds and widgeongrass, which flourished during the 1950's, are nearly gone in Dry Lake and are seriously depleted in Lake Bowdoin. As a result of these habitat changes, waterfowl production (Bowdoin's highest priority management objective) has declined seriously.

Problems caused by the poor water quality of the refuge also occur off-site. Discharges and seeps from the refuge cause problems for downstream irrigators, and alkali dust blows from dried-up ponds and marshes during the summer. The underlying cause is a lack of water to dilute salt concentrations by periodic flushing or flow-through water management.

Mean annual evaporation at Bowdoin is 3.5 feet, which translates to a total of 22,750 acre-feet of water lost annually from the refuge's 6,500 acres of wetlands. With mean annual precipitation supplying about 1 foot of water (or 6,500 acre-feet), irrigation return flows providing another 1,500 acre-feet in a normal season and Reclamation annually supplying 3,500 acre-feet of stored water (if available beyond irrigation needs), the annual water deficit is 11,000 acre-feet in an average year, up to 16,000 acre-feet during a dry year. During years of above-average runoff, Beaver Creek flood water reduces the deficit. In normal or dry years (7 or 8 out of every 10), the refuge must depend on water from Fresno Reservoir. This storage water has been unavailable during recent years due to increasing irrigation demands and below average precipitation. The effects on the refuge have been degraded habitat and reduced waterfowl production. Bowdoin's 1985 production is estimated to be 50 geese and 500 ducks, compared to normal production of 450 geese and 6,000 ducks.

Although management alternatives to deal with Bowdoin's water problems focus on construction and rehabilitation of facilities, a guaranteed water supply is the critical factor. The ideal volume of water needed to meet production objectives is a firm 16,000 acre-feet annually (representing the difference between evaporation and precipitation).

CHAPTER 3: RESOURCES

IRRIGATED LAND

The plan was formulated to provide water to all lands presently irrigated from the main stem of the Milk River. A total of 138,228 irrigated acres were identified by land classification investigations (USBR 1977).

All lands which are provided water from Reclamation facilities must be classified according to Reclamation specifications. Much of the irrigated land had been previously classified; the areas classified as part of this study include:

- Chinook Division.
- Lands irrigated outside district boundaries. This includes lands irrigated by contract pumpers and landowners with a junior water right.
- Certain lands along the proposed canal from the Missouri River to the Milk River, including Rocky Boys Reservation.

Milk River Project Lands

The Glasgow and Malta Divisions (including the Dodson Pump Unit) were classified in 1954 and 1955. (Arable and irrigated acreages are shown on Table 3.1.) Classifications were adequate for planning purposes, except for about 91 acres of Class 5D land on the Dodson Pump Unit which needed resolution. Of the 91 acres, 45 were determined to be arable, the rest Class 6 (nonarable).

The Glasgow, Malta, and CHinook Divisions are considered to be at equilibrium regarding drainage, that is that the water added to the groundwater equals the water withdrawn from groundwater annually (USBR 1987).

Table 3.1
Summary of Lands in Milk River Basin
(acres)

Class	Glasgow	Malta	Dodson Pump	Chinook	Contract Pumpers	Junior Water Rights	Fort Belknap Tribe	Total (rounded)
1	533.12	4,821.77	238.7					
2	2,415.61	6,193.31	652.7					
3	3,664.52	5,690.30						
3x	--	--	--					
4a	7,222.95	4,218.95	47.1					
4b	4,175.27	21,633.78						
5D	Reclassed as irrigable		45					
Arable	18,011.47 1/	42,558.11 1/	983.5 2/	35,000 3/	11,000 4/	26,607 4/	10,425	143,600
Equalization Pact	18,011.76	42,506.00	5/1,006.0	37,274	10,577	0		109,400
Irrigated	15,000.00	42,150.00	1,006.0	34,720	11,529	32,673	10,425	147,500
Served by Project	15,000.00	42,150.00	1,006.0	34,720 6/	10,330 6/	25,000	10,425	138,500 (rounded)

1/ 1955 land classification.
2/ 1954 land classification.
3/ Estimated arable lands within 1957 water-right boundaries.
4/ Preliminary figures based on 1985-87 classification.
5/ Adjusted to 42,487 acres by 1963 and 1985 reclassification.
6/ Some of the irrigated acres are Class 6. It is assumed that these lands would be irrigated or be retired and irrigation reinstated on irrigable lands. If the landowners in the districts do not wish to retire or transfer the water right, the lands will be class 6W. See 6W definition page 3.3

The Chinook Division was classified in 1957, but no land classification maps have been found. Also, arable acres were only delineated by 40-acre tracts. For these reasons, "semidetailed" land classification of the Chinook land was completed in 1985-86. About 35,000 acres are arable within the division boundaries. Drainage was considered a productivity factor, and salinity values were not adjusted to reflect any future drain construction on the irrigated lands.

Lands Irrigated by Contract Pumpers

As discussed under Water Rights Section, the Equalization Act Pact signed in 1967 gave the Milk River Project districts and pump contracts[1/] equal rights to the Milk River natural flow and water stored by the Milk River Project in Lake Sherburne, Fresno and Nelson Reservoirs. The 11,529 acres of lands irrigated by contract pumpers had never been classified until 1985-1987.

Preliminary figures indicate about 3,000 acres of irrigated lands with senior water rights were classed nonarable in the 1985-1987 survey. Irrigated Class 6 lands holding senior water rights will be handled according to Reclamation Instructions part 512.1.1a(6) which states:

"Class 6 irrigated land with existing water rights will be delineated and designated as class 6W. Every effort should be made to obtain consent for the retirement of 6W lands from irrigation and release or transfer of any water right to which it may be entitled. If this cannot be accomplished, such land will be shown as class 6W and provision made for supplying, under project operation, the amount of water normally available to it under existing rights."

The matter of irrigated Class 6 lands will be deferred until the preconstruction survey when the exact location will be known. For the PFWD, all irrigated Class 6 lands with senior water rights were included in the project. All Class 6 and 6D land with junior rights will not be included in the project.

1/ Landowners with individual pump contracts with the Bureau of Reclamation.

Lands Irrigated by Landowners with Junior Water Rights

According to on-the-ground investigations, about 44,000 acres are irrigated outside of the boundaries of the districts and Fort Belknap Reservation. About 11,000 of these are irrigated by contract pumpers.

The remaining 33,000 acres have an undetermined water right junior to Reclamation and tribal water rights. Of the 33,000 acres, about 25,000 acres are arable. Of the nonarable lands, 3,000 acres are Class 6, 3,500 Class 6D, and about 1,500 acres have not been classified because the landowners denied access. All lands that were considered undrainable because of shallow barriers or which have drain spacing requirements less than 50 feet were designated 6D, except for lands suitable for bluejoint hay (Class 3SX). The nonarable (Class 6 and 6D) lands with junior water rights were not included in the project.

Lands on Fort Belknap Reservation

Irrigated lands on the Fort Belknap Indian Reservation receive a water supply from the natural flow of the Milk River and one-seventh of the storage in Fresno Reservation. The Bureau of Indian Affairs is currently classifying reservation lands using their standards. This classification will be used in water rights negotiations. For this study, it was assumed 10,425 acres are presently irrigated and 14,000 additional acres will be developed by the Tribe in the future. The total of 24,425 acres is based on the headgate capacity of the diversion dam for the main canal on the reservation.

Lands Along Canal Route

Since the main stem of the Milk has been closed to new water rights since 1983, no new irrigation was considered for this study except the lands along the proposed canal route from the Missouri River near Virgelle to the Milk River near Havre (described in Chapter 4). New lands classified include privately-owned land and land on Rocky Boys Indian Reservation, as shown below:

	Private Canalside (acres)		Rocky Boys Reservation (acres)	
	Gravity or Sprinkler	Sprinkler Only	Gravity or Sprinkler	Sprinkler Only
1	1,175	82	505	357
2	1,291	384	1,632	439
3	1,162	364	1,621	144
Total Arable	4,456		4,698	

1985-1987 LAND CLASSIFICATION INVESTIGATION

The primary purpose of the land classification investigation was to determine the acreage of irrigated land suitable for sustained irrigation. This investigation separated arable land from nonarable land. Arable land is land which, when farmed in adequately sized units for the prevailing climatic and economic setting and provided with the essential farm improvements (removing vegetation and other cover, leveling, soil reclamation, drainage, and irrigation-related facilities), will generate enough income under irrigation to pay all farm production expenses. Arable land will provide a reasonable return to the farm family's labor, management, and capital and pay the operation, maintenance, and replacement costs of associated project irrigation and drainage facilities. In short, the arable area comprises all land delineated in the land classification investigation that will provide sufficient income to warrant consideration for irrigation development. The combined effect of soil texture, soil structure, permeability, depth, salinity, alkalinity, slope, undulations, drainage, cover, stoniness, and field size are some of the major factors considered in arriving at a land class.

Land classes are defined in terms of family income and payment capacity. Arable lands were divided into Classes 1, 2, 3, 3X, S1, S2, and S3 during the 1985-87 investigations. These are economic classifications in which physical differences in land reflect differences in net income.

The standards used are shown on Table 3.2. The main soil deficiencies marked in the survey area are fine soil textures (h factor), salinity (s factor), and sodicity (a factor). Topographic deficiencies include cover removal (c factor), grading requirements (u factor), and small field size (j factor). Onfarm drainage problems were considered a productivity factor (o factor). Irrigated lands were classified considering the present situation and a moderate intensity of management.

Since most lands irrigated by contract pumpers and landowners with junior water rights have been irrigated less than 40 years, drainage was not considered to be at equilibrium at the beginning of the study. Therefore, a drainage investigation was completed to determine the cost of artificial drainage. Lands with sufficient natural drainage for sustained irrigation were identified. Most of the remaining lands will require artificial drainage for continued diversified crop production or slowly degrade over the next 40 years. Certain croplands with clay soils may be converted to bluejoint hay production. The lands were classified based on the current situation. Drainage was considered a productivity factor; costs and benefits of proposed drainage were not considered in the land classification.

Preliminary results of the 1985-87 Land Classification investigation are shown on Table 3.1. Supporting information for the land classification study (listed below) is on file in Reclamation's Great Plains Regional Office in Billings, Montana.

Big Sandy Valley Lands Appendix
Milk River Valley Lands Appendix
Milk River Equilibrium Study Report

TABLE 3.2

United States
Department of the Interior
Bureau of Reclamation
Great Plains Region

GRAVITY-SPRINKLER IRRIGATION LAND CLASSIFICATIONS SPECIFICATIONS

MILK RIVER PROJECT, MONTANA

LAND CHARACTERISTICS	Symbols	CLASS 1 - ARABLE Gravity	Sprinkler 2/
SOILS	s		
Texture (surface)		Sandy loam to clay loam.	Same
Coarse (sandy)	v	Loamy coarse sand or sand permitted below 30 inches. Waterholding capacity of 6 or more inches in the upper 48 inches.	Same
Fine (clayey)	h	Clay not permitted in top 12 inches.	Same
Depth of coarse sand, gravel, or cobble	k	Greater than 30 inches with available waterholding capacity of 6 inches or more in the upper 48 inches.	Same
Sodicity at equilibrium with irrigation water	a	SAR should be less than 10 in fine (clay) texture soils but may range to 15 in coarse (sandy) textured soils.	Same
Salinity at equilibrium	e	ECe usually less than 4 millimhos per centimeter.	Same
Depth to sandstone, shale, or other impervious strata	z	60" plus.	Same
TOPOGRAPHY	t		
Gradient	g	0 to 2 percent in general gradient in reasonably large bodies.	Same to e but [illegible] use would incl
Irrigation pattern	j	Regular shaped fields exceeding 8 acres with runs longer than 400 feet. Increasing irregularity in shape of field will be permitted as size increases above minimum.	Mini acre
Surface leveling or grading	u	Can be accomplished with $200 or less per acre.	Can for acre
Surface cobble or stone removal	r	Can be accomplished with $200 or less per acre.	Can for acre
Cover (trees and brush) removal	c	Can be accomplished with $200 or less per acre.	Can for acre
DRAINAGE	d		
On-farm drainage	o	No on-farm drainage problems.	Same
PERCEIVABLE DEVELOPMENT COST 1/		$200 or less per acre.	$1
CLASS 6 - NONARABLE		Lands which do not meet the min	

1/ Based on Class 1 productivity. Cost of sprinkler equipment is not i
2/ Based on most productive Class IX lands.
3/ Locally, Class IX lands are most suitable for western wheatgrass (bl
4/ Arable lands which do not meet the criteria for gravity irrigation.

Revised January 1988

TABLE 3.2

United States
Department of the Interior
Bureau of Reclamation
Great Plains Region

GRAVITY-SPRINKLER IRRIGATION LAND CLASSIFICATIONS SPECIFICATIONS

MILK RIVER PROJECT, MONTANA

LAND CHARACTERISTICS	Symbols	CLASS 1 - ARABLE		CLASS 2 - ARABLE		CLASS 3 - ARABLE		CLASS 3X - ARABLE	
		Gravity	Sprinkler 4/	Gravity	Sprinkler	Gravity	Sprinkler	Gravity	Sprinkler
SOILS	s								
Texture (surface)		Sandy loam to clay loam.	Same as gravity.	Loamy sand to light clay.	Same as gravity.	Loamy sand to clay.	Same as gravity.	Clay (50 percent or more clay content). Bowdoin type soil.	Same as gravity.
Coarse (sandy)	v	Loamy coarse sand or sand permitted below 30 inches. Waterholding capacity of 6 or more inches in the upper 48 inches.	Same as gravity.	Loamy coarse sand or sand permitted below 20 inches with available waterholding capacity of 4.5 inches or greater in the upper 48 inches.	Same as gravity.	Loamy coarse sand or sand permitted below 12 inches with available water holding capacity of 3 inches or greater in the upper 48 inches.	Same as gravity.	N/A	Same as gravity.
Fine (clayey)	h	Clay not permitted in top 12 inches.	Same as gravity.	Light clay permitted in top 12 inches.	Same as gravity.	Entire profile may be clay if infiltration rate is adequate for plant moisture requirements and salt balance.	Same as gravity.	Entire profile in upper 60 inches may exceed 50% clay if infiltration rate is adequate for plant moisture requirements and salt balance.	Same as gravity but only occasionally sprinkler irrigated.
Depth of coarse sand, gravel, or cobble	k	Greater than 30 inches with available waterholding capacity of 6 inches or more in the upper 48 inches.	Same as gravity.	Greater than 20 inches with available waterholding capacity of 4.5 inches or greater in the upper 48 inches.	Same as gravity.	Greater than 12 inches with available water-holding capacity of 3 inches or greater in the upper 48 inches.	Greater than 6 inches with available water-holding capacity of 3 inches or greater in the upper 48 inches.	N/A	Same as gravity.
Sodicity at equilibrium with irrigation water	a	SAR should be less than 10 in fine (clay) texture soils but may range to 15 in coarse (sandy) textured soils.	Same as gravity.	SAR should be less than 12 in fine (clay) texture soils but may range to 20 in coarse (sandy) textured soils.	Same as gravity.	SAR should be less than 15 in fine (clay) texture soils but may range to 25 in coarse (sandy) textured soils.	Same as gravity.	SAR usually less than 25.	Same as gravity.
Salinity at equilibrium	e	ECe usually less than 4 millimhos per centimeter.	Same as gravity.	ECe usually less than 6 millimhos per centimeter.	Same as gravity.	ECe usually less than 8 millimhos per centimeter.	Same as gravity.	ECe usually less than 15 millimhos per centimeter.	Same as gravity.
Depth to sandstone, shale, or other impervious strata	c	60" plus.	Same as gravity.	60" plus.	Same as gravity.	60" plus.	Same as gravity.	N/A	N/A
TOPOGRAPHY	t								
Gradient	g	0 to 2 percent in general gradient in reasonably large bodies.	General gradient not to exceed 8 percent but may include small [illegible] would exceed this slope limitation when land use considerations would dictate this inclusion.	2 to 4 percent in general gradient in reasonably large bodies.	Same as Class 1 sprinkler.	4 to 6 percent in general gradient in reasonably large bodies.	Same as Class 1 sprinkler.	Usually level to nearly level. 0 to 2 percent in large bodies.	Same as gravity.
Irrigation pattern	j	Regular shaped fields exceeding 8 acres with runs longer than 400 feet. Increasing irregularity in shape of field will be permitted as size increases above minimum.	Minimum size of 20 acres.	Regular shaped fields exceeding 5 acres with runs longer than 300 feet. Increasing irregularity in shape of field will be permitted as size increases above minimum.	Same as Class 1 sprinkler.	Regular shaped fields exceeding 2 acres with runs longer than 100 feet. Increasing irregularity in shape of field will be permitted as size increases above minimum.	Same as Class 1 sprinkler.	Same as Class 3 gravity.	Same as Class 1 sprinkler.
Surface leveling or grading	l	Can be accomplished with $200 or less per acre.	Can be accomplished for $100 or less per acre.	Can be accomplished with $600 or less per acre.	Can be accomplished for $400 or less per acre.	Can be accomplished with $1,000 or less per acre.	Can be accomplished for $700 or less per acre.	Can be accomplished with $500 or less per acre.	Can be accomplished for $300 or less per acre.
Surface bottle or stone removal	r	Can be accomplished with $200 or less per acre.	Can be accomplished for $100 or less per acre.	Can be accomplished with $600 or less per acre.	Can be accomplished for $400 or less per acre.	Can be accomplished with $1,000 or less per acre.	Can be accomplished for $700 or less per acre.	Can be accomplished with $500 or less per acre.	Can be accomplished for $300 or less per acre.
Cover (trees and brush) removal	c	Can be accomplished with $200 or less per acre.	Can be accomplished for $100 or less per acre.	Can be accomplished with $600 or less per acre.	Can be accomplished for $400 or less per acre.	Can be accomplished with $1,000 or less per acre.	Can be accomplished for $700 or less per acre.	Can be accomplished with $500 or less per acre.	Can be accomplished with $300 or less per acre.
DRAINAGE	d								
Onfarm drainage	o	No onfarm drainage problems.	Same as gravity.	Onfarm drainage factors will cause yield reductions up to 25 percent.	Same as gravity.	Onfarm drainage factors will cause yield reductions up to 50 percent.	Same as gravity.	N/A	N/A
PERMISSIBLE DEVELOPMENT COST 1/		$700 or less per acre.	$100 or less per	$600 or less per acre.	$400 or less per	$1,000 or less per acre.	$700 or less per acre.	$500 or less per acre 2/	$300 or less per acre.
CLASS 6 - NONARABLE		Lands which do not meet the minimum requirements for either gravity or sprinkler arable lands.							

1/ Based on Class 1 productivity. Cost of sprinkler equipment is not considered a development cost.
2/ Based on most productive Class 3X lands.
3/ Locally, Class 3X lands are most suitable for western wheatgrass (bluejoint) hay. Yields average about 2 tons per acre.
4/ Arable lands which do not meet the criteria for gravity irrigation.

WATER SUPPLY

The Milk River Simulation Model

Determining historic and future water shortages in the Milk River Basin is the most critical element for evaluating proposed plans. The amount and frequency of shortages in the basin were estimated from a computer simulation model developed by the Department of Natural Resources and Conservation (DNRC) and Reclamation, using the format of the OPSTUDY river basin model. The Milk River model estimated monthly streamflows, irrigation diversions, and reservoir contents over the period 1927-1985.

Data required by the model included historic streamflows, crop irrigation requirements, irrigation efficiencies, canal capacities, and irrigated acreages, as well as reservoir capacities, area capacity tables, and seepage and evaporation rates. Details of the model can be found in Attachment 1 at the back of this report.

The model showed that a mean annual diversion of 4.6 acre-feet/acre is necessary to satisfy the 1 acre-foot/acre crop irrigation requirement for current conditions. The estimated mean annual diversion is currently only 3.7 acre-feet/acre, with 0.8 acre-feet/acre being delivered to the crop root zone. There is, therefore, a mean annual diversion shortage of 0.9 acre-feet/acre, which translates into a 0.2 acre-feet/acre shortage in crop water requirement.

Figure 3.1 illustrates how insufficient water supply and inadequate (facility) capacity in project facilities contribute to the irrigation shortages of the Milk River Project. The figure depicts an average canal cross section of the Milk River Project. As shown, historic average diversion demand exceeds the canal capacity and the increment of demand above the canal capacity (0.5 acre-foot/acre) represents the mean annual facility shortage. The historic average water supply, however, is not sufficient to fill the canal and thus a water supply shortage (0.4 acre-foot/acre), also contributes to the problem.

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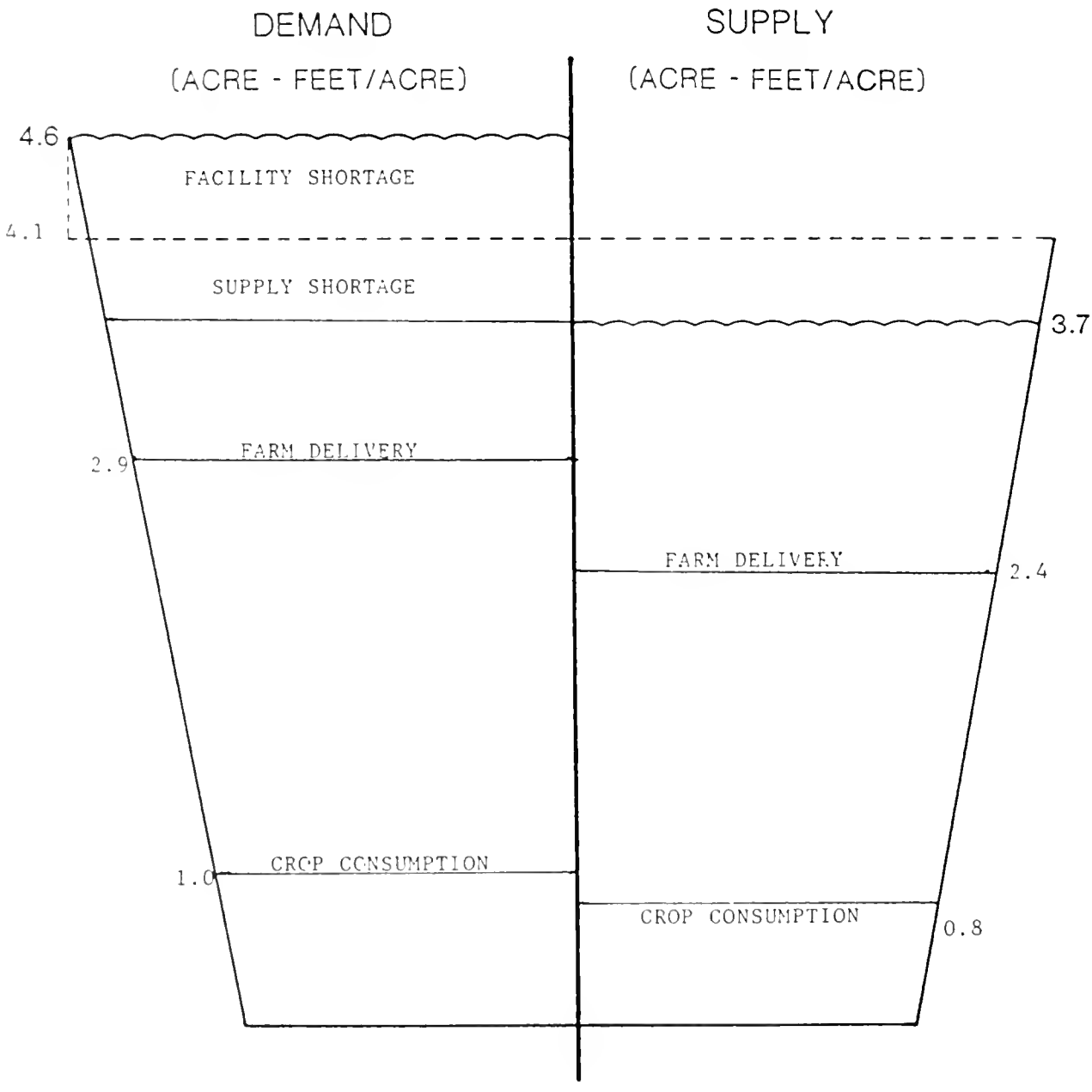
Figure 3.1

IRRIGATION SHORTAGES

CURRENT CONDITIONS



The relatively high facility shortage has been substantiated by talks with ditch riders and irrigators, who confirm that many canals cannot carry enough irrigation water to satisfy the lower reaches.

Under current conditions (present irrigated acreage under historic climatic conditions between 1927-1985), the average annual demand[1/] for districts, contract pumpers, landowners with junior water right acres, and the Fort Belknap Reservation is estimated to be 632,700 acre-feet. The average annual facility shortage is 62,900 acre-feet (10 percent), and the water supply shortage 61,200 acre-feet (9 percent). The estimated shortage in 1984 is 289,700 acre-feet. Shortages exceed 10 percent of the demand 6 out of 10 years.

1/ This demand is the total diversion required at the headgates of the canals.

CHAPTER 4: PLAN FORMULATION

PLAN FORMULATION OVERVIEW

At the onset of this study, the problem in the Milk River Basin appeared to be an inadequate water supply, which could be alleviated with a source of supplemental water. Offstream storage sites and importing water from Lake Elwell (Tiber Reservoir), the Missouri River, or Fort Peck Reservoir were evaluated. (These alternatives are discussed in detail in "Canal Routes and Alternatives Dropped from Consideration" at the end of this chapter.) Of these sources of supplemental water, only the Virgelle-Milk Canal Alternative was economically justified and warranted further study. Water would be pumped from the Missouri River near Virgelle to be conveyed to the Milk River near Havre to alleviate current and future shortages. As explained in the "Problems and Needs" Chapter, the current average annual water supply shortages are expected to increase about 28,000 acre-feet in the future when the Canadians and Fort Belknap Reservation Tribes use their legal share of the Milk River water.

As the water supply problems of the basin were evaluated in more detail and more information was collected, it became evident that water shortages are caused by more than an inadequate water supply. The aging canals of the Milk River Project do not have adequate capacity to convey enough water to meet crop demands given the current system efficiencies. (System efficiencies are estimated at 17 percent. See "Water Supply" in Chapter 3.) Thus, even if an adequate basin water supply were available, many of the irrigators would not receive an adequate water supply to meet crop demands. In addition, measuring devices at all farm turnouts and laterals and a Joint Board of Control are needed for equitable distribution and management of the existing supply.

Therefore, a three-phase plan was formulated that would include better management of the water available, rehabilitation of the entire system (conveyance and onfarm facilities) to reduce headgate demand to canal capacity, and a new water supply.

Phase 1 has been initiated. A Joint Board of Control is being established to coordinate the basin-wide management of water, and the St. Mary Canal is being restored to its original design capacity.

The Joint Board of Control, which would be made up of irrigation district supervisors elected by the water users, would coordinate and consolidate irrigation operation and maintenance. This would result in more efficient and effective use of water, equipment, and district staff.

The St. Mary Canal diverts St. Mary River water to the Milk River. This canal is undergoing restoration to obtain more of the U.S. share of water, as apportioned by the Boundary Waters Treaty of 1909. Rehabilitation of the canal could reduce average annual shortages by an estimated 16,000 acre-feet.

Phase 2 would focus on reducing demand at canal headgates by improving conveyance efficiencies through rehabilitation of the canal and laterals, and increasing onfarm irrigation efficiencies. This would enable canals to carry enough water to meet crop needs. Phase 2 includes three elements--Rehabilitation and Betterment, Construction and Rehabilitation, and Onfarm Efficiency Improvement. In addition to conserving water, implementation of these three elements would improve distribution of water, increase crop yield, reduce labor, improve operation and maintenance, and permit reclamation of lands affected by canal seepage.

Reclamation is completing Rehabilitation and Betterment (R&B) Reports for Malta and Glasgow Divisions. The Montana Department of Natural Resources and Conservation (DNRC) is completing similar reports for the Chinook Division and Dodson Pumping Unit.

Phase 2 costs were estimated assuming only the districts and contract pumpers would participate in the three elements. These irrigators would also be the primary beneficiaries. Until basin water rights are adjudicated and a river commissioner appointed, landowners with junior water rights

will continue to irrigate even during periods when the water supply is only adequate for landowners with senior water rights. Under this operation the Milk River Project districts, contract pumpers, and landowners with junior water rights should have an adequate water supply. It is estimated that average annual shortages would be about 3 percent, and shortages that exceed 10 percent of demand would only occur 1 of 10 years. The inequity of this operation is that the landowners with junior water rights are receiving a water supply from the Milk River Project facilities (St. Mary Canal, Sherburne Lake, Fresno Reservoir, and Nelson Reservoir) at no cost. One way to resolve this inequity is for all irrigators to share the available water and to share all costs to provide the water. This would require agreement by all parties and negotiation of a new repayment contract, similar to the Equalization Pact of 1967 (see "Water Rights" in Chapter 2).

Another way to resolve the inequity is to complete the adjudication of the Milk River Basin water rights, and to enforce the water rights by appointment of a river commissioner. This would result in a very inadequate water supply for the landowners with junior water rights. Sixty percent of the time, their water shortages would exceed 10 percent of their demand. In extremely dry years, they would be completely without water. With these extreme conditions, landowners with junior water rights would probably revert to dryland farming.

Phase 3 was formulated to provide an adequate water supply to the landowners with junior water rights, Gros Ventre-Assiniboine Tribes on the Fort Belknap Reservation (where the water supply would be a part of the reserved water right), Bureau of Land Management stockwater ponds (through exchange with tributary water), Bowdoin National Wildlife Refuge, and the town of Chinook. The Preferred Plan is a 230 ft^3/s pumping plant on the Missouri River near Virgelle and a canal from the Missouri to the Milk River near Havre, a distance of 46 miles. Water would be provided to landowners along the canal, including the Chippewa Cree Tribe on the Rocky Boy's Reservation.

Phase 3 is presented in this chapter.

DESCRIPTION OF PHASE 1

Elements of Phase 1

Phase 1 is being completed by the Milk River irrigators. This phase includes formulation of a Joint Board of Control and restoring St. Mary Canal to its original design capacity.

St. Mary Canal Restoration

Lake Sherburne Dam, St. Mary Diversion Dam, and St. Mary Canal were constructed in the 1910's. The lake behind Lake Sherburne Dam stores St. Mary River water. St. Mary Canal begins at St. Mary Diversion Dam on the west side of St. Mary River near Babb, Montana, discharges into the North Fork of the Milk River (see the map at the front of this report). The canal is 29 miles long. The original design capacity was 850 ft^3/s; present capacity is estimated at 700 ft^3/s.

St. Mary River is a critical element of the water supply available in the Milk River Basin. Mean annual flow at the eastern crossing of the border is 267,150 acre-feet/year, about half of which comes from the St. Mary River Basin. Therefore, the Milk River Project irrigators are restoring the St. Mary Canal to its original design capacity, by reshaping the canal banks. This work is being done as an extraordinary operation and maintenance program and should be completed in 1991.

Joint Board of Control

The Milk River irrigators are in the process of forming a Joint Board of Control. The Board will be made up of representatives elected by the water users. Initially the Board could administer water usage and the Milk River Project works. This would allow the private and Federal sectors along the Milk River to work together for the benefit of all users. The Board's authority eventually could be expanded to include operation and maintenance of all facilities.

Effects of Phase 1

The Joint Board of Control will result in a more efficient use of water, equipment, and district staff.

The restoration of St. Mary Canal will reduce the average annual shortages in the basin by 16,000 acre-feet.

Costs of Phase 1

The St. Mary Canal is being restored through a special assessment included in the annual Milk River Project OM&R for a period of 5 years.

The cost for forming the Joint Board of Control has not been estimated.

DESCRIPTION OF PHASE 2
("Future Without the Project Condition" or No Action Alternative)

Phase 2 includes three R&B Program elements--Rehabilitation and Betterment, Construction and Rehabilitation, and Onfarm Efficiency Improvement. These three are summarized below and described in more detail in Attachment 3 and in the Rehabilitation and Betterment Program reports for the Malta Division, Glasgow Division, Chinook Division and Dodson Pump Unit (see "References").

Phase 2 represents what could happen if the basin water supply were not increased in Phase 3. Therefore, Phase 2 is used as a base for comparison of the economic, environmental, and social effects of Phase 3. It is referred to as the Future Without the Project Condition (without Phase 3), or No Action Alternative in this report. It is assumed Phase I will be completely implemented before Phase 2 is begun.

Elements of Phase 2

Rehabilitation and Betterment

The facilities of the Milk River Project (Malta, Glasgow, and Chinook Divisions and the Dodson Pump Unit) would be rehabilitated. This includes relocating, rebuilding, or enlarging reaches of canals; lining canals with compacted earth, membrane material, or concrete; replacing canal structures; realigning or deepening existing drains; constructing new drains; lining laterals or installing pipe; and installing measuring devices. This work would focus on the most serious problems.

Construction and Rehabilitation

This element would be an expansion of the Rehabilitation and Betterment element. The project distribution system (structures, canals, laterals and drains) would be upgraded. Obsolete structures such as diversion dams would be modified or replaced. Measuring devices would be installed on all laterals and farm turnouts.

Onfarm Efficiency Improvement

Onfarm improvements (leveling fields, raising border dikes, lining ditches, installing gated-pipe, sprinklers, and concrete-lined head ditches with automated control) would be coupled with improved irrigation scheduling and operational changes.

Presently, the Soil Conservation Service (SCS) works with the operators in the basin to improve onfarm irrigation efficiencies. Reclamation wants to maintain the relationship the SCS has with the farmers. To implement the Onfarm Efficiency Element, Reclamation suggests that the funds be transferred to the Agricultural Stabilization and Conservation Service (ASCS). through a Memorandum of Understanding (MOU). The SCS would provide technical assistance to the farmers. Annually, the ASCS in cooperation with Reclamation and the Milk River Joint Board of Control would agree on the onfarm improvements to be done that year. After agreement the funds would be transferred to the ASCS.

Each irrigation district would receive onfarm improvement funds based on the ratio of irrigated area in each district to the total irrigated area. For example:

Glasgow District	18,000 acres
Total Project	103,000 acres

$$\frac{18,000}{103,000} = 17 \text{ percent}$$

Glasgow District would receive 17 percent of the onfarm funds.

Effects of Phase 2

These three elements will upgrade the distribution system, improve drainage and help drain extensive seeps, improve distribution of available water, improve operation and maintenance, increase crop yield, decrease labor required for farm operations, and reduce demands at the headgates so canals are capable of delivering enough water to crops.

Effects on Water Demand and Shortages

To evaluate the effect of each element of Phase 2 on the water supply, a sequence of events was selected:

1. Present condition (historical)
2. Restoration of St. Mary Canal (St. Mary)
3. Canadian development of their full share of Milk River water supply (Canadian)
4. Development of 14,000 additional acres on Fort Belknap Reservation (Indian)
5. Implementation of Rehabilitation and Betterment element (R&B)
6. Implementation of Construction and Rehabilitation element (C&R)
7. Implementation of Onfarm Efficiency Improvement element (Onfarm)
8. Adjudication Completed and Water Rights Enforced (Adjudication)

Table 4.1 and Figure 4.1 show the effect of this sequence of events on the demands and shortages for the districts, contract pumpers, and junior water right landowners. Table 4.2 and Figure 4.2 show the effect on the demands and shortages of the Fort Belknap Reservation Tribes. The demands and shortages are based on 138,500 acres of land presently irrigated and 14,000 new acres on Fort Belknap Reservation:

Water User	Acres
Districts and Contract Pumpers	103,206
Landowners with Junior Water Rights	25,000
Fort Belknap Indian Reservation	10,425
Existing Irrigated Acres (Rounded)	138,500
New Acres on Fort Belknap Indian Reservation	14,000
Future Irrigated Acres	152,500

Data used to compute the shortages were based on the best available information. Accurate data on water usage in the basin is difficult to obtain due to lack of project measuring devices. As part of the rehabilitation program, measuring devices will be installed at all canal and lateral headworks and at all turnouts. These will help assure equitable distribution of water and will also provide the necessary data to compute system efficiencies.

The average annual demand is based on the average annual crop irrigation requirement (CIR) and conveyance and onfarm efficiencies. For example, if the CIR were 1 acre-foot/acre, the onfarm efficiency 27 percent and the conveyance efficiency 64 percent, the diversion demand at the headgate would be 5.9 acre-feet per acre (1 divided by (.27 x .64)]. This means that 5.9 acre-feet per acre would have to be diverted to deliver 1 acre-foot to the crop. If the diversion demand is greater than the canal capacity, the increment of demand above the canal capacity represents the "facility shortage." If the water supply were insufficient to fill a canal, there would be a "water supply shortage." (See Attachment 1, "Water Supply Simulation Model" for more details.) Both water supply and facility shortages represent a shortage to the crop.

Shortages of District, Contract Pumpers and Junior Water Right Landowners.-- As shown on Table 4.1 and Figure 4.1, restoring St. Mary Canal will decrease the average annual water supply shortage of the districts, contract pumpers and landowners with junior water rights by about 16,000 acre-feet (59,700 minus 43,800 acre-feet). Canadian and Indian development will increase average annual water supply shortage by about 28,000 acre-feet (from 43,800 to 71,800 acre-feet). This 71,800 acre-foot water supply shortage coupled with the 62,900 acre-foot facility shortage (caused by water demands greater than canal capacity) results in a total average annual demand of 134,700 acre-feet or about 23 percent of the average annual total demand. The Rehabilitation and Betterment, Construction and Rehabilitation, and Onfarm Efficiency Improvement elements will reduce the average annual canal headgate demand from 593,600 to 344,000 acre-feet, or a 42-percent improvement. The canals would have adequate capacity to carry the water needed to meet the crop irrigation demands; there would be essentially no facility shortage, while average annual water supply shortage would only be 10,300 acre-feet, or 3 percent of average annual demand.

In the driest year of the study period, the shortage would be 103,000 acre-feet or 24 percent of average annual demand after implementation of Phase 1. Extreme shortages (greater than 10 percent of demand) would occur on average only 1 year out of 10 compared to 6 years out of 10 currently.

The water supply at present is used by all irrigators in an upstream-downstream order, regardless of water right priority. The water supply is not distributed based on priority because basin water rights have not been adjudicated, no river commissioner has been appointed to enforce water rights, there are few measuring devices, and there is no joint board of control to manage water distribution in the basin.

Enforcement of adjudicated water rights would reduce shortages for district and contract pumpers another 50,000 acre-feet during dry years (see items 4 and 5 on Table 4.1). With these shortages the districts and contract pumpers would not need additional water beyond that supplied by Phase 2.

With Phase 2 in place there would still be shortages in the basin. After adjudication of water rights are enforced, the 25,000 acres of land

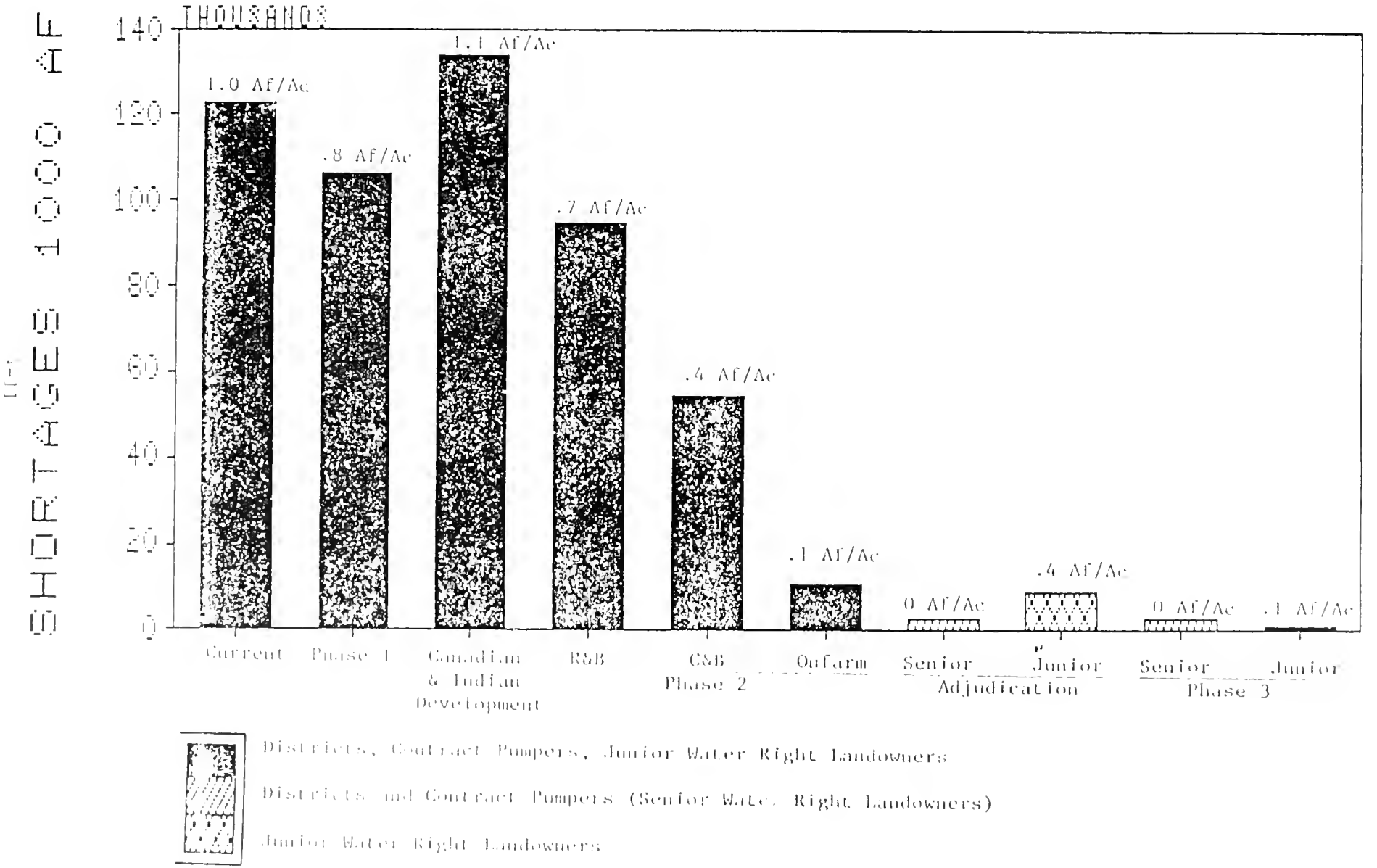
Table 4.1

SUMMARY OF CUMULATIVE EFFECTS OF THREE-PHASE PLAN

ON DEMANDS AND SHORTAGES OF DISTRICTS, CONTRACT PUMPERS, AND JUNIOR WATER RIGHT LANDOWNERS

Scenario	Average Annual Demand (Acre-feet)	Average Annual Facility Shortage (Acre-feet)	Average Annual Water Supply Shortage (Acre-feet)	Maximum Water Supply Shortage 1984 (Acre-feet)	Frequency of Water Supply Shortages that Exceed 10% of Demand
Before Adjudication Enforced - Districts, Contract Pumpers and Junior Water Right Landowners					
1. Current	593,600	62,900	59,700	266,700	6 years out of 10
2. Phase 1 Complete	593,600	62,900	43,800	249,400	6 years out of 10
3. Canadian, Indian Development	593,600	62,900	71,800	243,100	7 years out of 10
4. Phase 2					
R&B	532,000	38,300	56,300	230,590	5 years out of 10
R&B and C&B	454,500	17,100	36,900	187,900	4 years out of 10
R&B, C&B and Onfarm	344,000	1,600	10,300	103,000	1 year out of 10
5. Adjudication Enforced					
Districts and Contract Pumpers	299,600	1,600	1,200	51,000	1 year out of 10
Junior Water Right Landowners	44,400	-----	9,100	52,000	6 years out of 10
6. Phase 3 District and Contract Pumpers	299,600	1,600	1,200	51,000	1 year out of 10
Junior Water Right Landowners	44,400	———	1,600	17,500	1 year out of 10

FIGURE 4.1
AVERAGE ANNUAL WATER SUPPLY AND FACILITY SHORTAGES
MILK RIVER BASIN



irrigated under junior water rights would bear these shortages. Diversions for these 25,000 acres would be reduced or completely shut off. In 6 out of 10 years, shortages on these lands would be at least 10 percent of average annual demand. In 1 out of 10 years the shortages would be at least 50 percent. In dry years like 1941 and 1984, these lands would be completely without water. Landowners with junior rights would probably revert to dryland farming in such an eventuality.

Fort Belknap Reservation Shortages.--Table 4.2 and Figure 4.2 show the shortages for the Fort Belknap Reservation Tribes. Assuming the Tribes are entitled to all natural flows of the Milk River and tributaries upstream of and passing through the reservation, the average annual water shortage would be 6,200 acre-feet, or 11 percent of their average annual demand, for 24,425 acres (see line 5 of Table 4.2). In a year like 1984, with limited natural flow, shortages would exceed 80 percent. This level of shortages assumes the Tribes will continue to update their existing system through a rehabilitation program similar to Phase 2 proposals. Funding has been obtained through the Bureau of Indian Affairs for rehabilitation in the past.

Other Water Users Shortages.--If water rights were adjudicated and strictly administered, another 3,700 acre-feet could be provided to Lake Bowdoin per year on average, without increasing the district shortages. For Phase 3 analysis it was assumed Lake Bowdoin would still need 15,700 acre-feet of water, the town of Chinook 400 acre-feet, and the Bureau of Land Management 7,500 acre-feet.

Environmental Effects

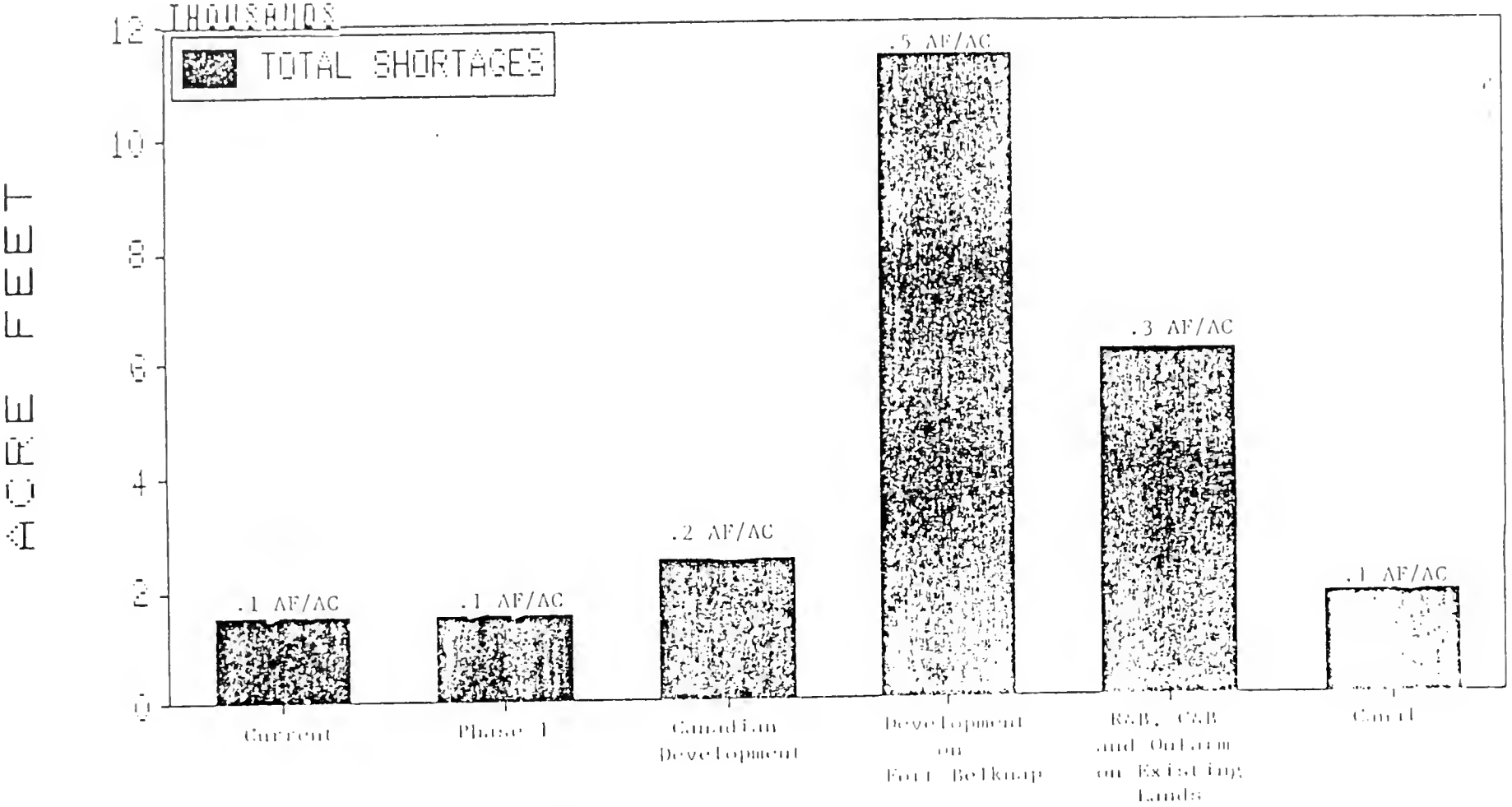
Canal, lateral and drain rights-of-ways offer riparian habitat and vegetative cover for many species. Over the years, canal seepage has created several large seeps, providing important habitat to terrestrial species. Improving the delivery systems in Phase 2 will reduce seepage, drying up these artificially created wetlands.

Table 4.2
SUMMARY OF CUMULATIVE EFFECTS OF THREE PHASE PLAN ON DEMANDS AND SHORTAGES
OF FORT BELKNAP INDIAN RESERVATION TRIBES

Scenario	Average Annual Demand (Acre-feet)	Average Annual Facility Shortage (Acre-feet)	Average Annual Water Supply Shortage (Acre-Feet)	Maximum Water Supply Shortage 1984 (Acre-Feet)	Frequency of Water Supply Shortages that Exceed 10% of Demand
1. Current	39,900	0	1,500	23,900	1 year out of 10
2. Phase 1 Complete	39,900	0	1,500	23,900	1 year out of 10
3. Canada Development	39,900	0	2,500	25,100	2 years out of 10
4. Development of 14,000 acres on reservation	71,700	1,400	11,400	60,300	5 years out of 10
5. Phase 2 (R&B, Onfarm, C&R)	56,300	0	6,200	46,400	3 years out of 10
Adjudication Enforced					
Phase 3	56,300	0	1,800	26,000	1 year out of 10

WATER SUPPLY AND FACILITY SHORTAGES

FORT BELKNAP INDIAN RESERVATION



Although threatened or endangered species such as the piping plover, peregrine falcon, black-footed ferret, and bald eagle may occur in the area, none should be affected by Phase 2 according to the U.S. Fish and Wildlife Service (USFWS).

The following wildlife mitigation measures have been recommended by USFWS:

1. Areas should be managed for wildlife to compensate for habitat lost as a result of Phase 2. These include 2,755 acres in the Beaver Creek area, 1,340 acres next to Nelson Reservoir, 553 acres near the Dodson Canal, 400 acres west of Vandalia Diversion Dam, and 5,600 acres in the Lonesome Lake area.

2. Some newly lined canals and laterals could entrap deer. Escape mechanisms are recommended for every -mile in the initial reaches of laterals DN-104, DS-50 and DS-140. The Vandalia South Canal should be monitored to see if deer are trapped. If so, the canal should be fenced.

Phase 2 will not result in significant changes in flow regimens of the Milk River. Impacts to fishery resources associated with historic dewatering and low flows in the Milk River will continue. Operation of Fresno and Nelson Reservoirs under Phase 2 should result in a general improvement in fishery habitat. Changes in waterfowl use of the river or around Fresno Reservoir are not expected.

No known cultural resources would be affected, but surveys will be taken where earth-disturbing activities are to take place. Since the Milk River Project is one of the oldest Federal irrigation projects in the nation, the historical significance of certain project features will also have to be evaluated.

Social Effects

Phase 2 would help alleviate water shortages in the basin; however, little change in economic and social conditions is anticipated in the area. Agriculture will continue to be the primary basic industry, with principal crops including alfalfa, barley, and wheat. Cattle grazing would continue to be an integral part of most operations.

Although overall population in the area is projected to increase by about 10 percent by the year 2000, all increases will take place in the larger cities and towns like Great Falls, Havre, Fort Benton, Malta, and Glasgow (Department of Commerce, 1970). However, the actions in Phase 2 should help stem the historical losses of rural population in the area.

Employment, commensurate with population trends, will continue to follow area historical patterns of increases in urban areas, and decline in rural areas. Unemployment on the Fort Belknap and Rocky Boy's Reservations (currently at about 70 percent) will continue at relatively high levels (Department of Commerce, 1970).

Per capita income will remain below the national average. Although current income for the area is expected to increase by about 60 percent by the year 2000, income in the agriculture sector is expected to increase by only 35 percent over the same period (Department of Commerce, 1970). Phase 2 will provide more direct agricultural income each year of about $6.1 million, and indirect income of about $2.4 million. Annual equivalent economic costs of Phase 2 would be about $8.7 million.

As of the 1980 census, there was a 20-percent housing vacancy rate in the five counties of the project area (Department of Commerce, 1980). A comparable rate would continue into the future due to depressed agricultural economics and the long-term population trend to move away from rural into urban areas. Like most rural areas in Montana, social and medical services will be difficult to obtain. Phase 2 will not affect these services.

Costs of Phase 2

Estimated construction costs for the three elements of Phase 2 are as follows:

Element	Cost
Rehabilitation and Betterment	$ 14,200,000
Construction and Rehabilitation	68,400,000
Onfarm Efficiency Improvement	$ 18,600,000
TOTAL	$101,200,000

In addition, onfarm drains should be installed as needed on contract pump lands. USBR's drainage investigations show that about $12 million is required for onfarm drains over the next 40 years. The drains could be constructed through the Drainage and Minor Construction Program.

Financial Analysis of Phase 2

The districts' ability to repay a Phase 2 loan is demonstrated by the use of a farm budget analysis (see Attachment 2 at the end of this report). This analysis shows that no payment capacity exists, as traditionally measured when net farm income is reduced to operator and family labor, return to management, and return to equity. However, the landowners can repay the loans if they are willing to obligate part of their disposable income, the average disposable income being $19,500 per farm (Attachment 2). Allowing the Department of the Interior standard of $18,108 for family living, the average yearly payment would be $1,392 per farm, or $4.67/acre (based on 298 irrigated acres/farm). This level would limit rehabilitation of the system to the Rehabiliation and Betterment element of Phase 2.

The irrigators want to financially integrate complete rehabilitation of the system (Phase 2) into the Pick-Sloan Missouri Basin Program (P-S MBP). The cost of the rehabilitation exceeding the willingness of irrigators to pay would be repaid by P-S MBP power revenues. Integration would require Congressional authorization.

The P-S MBP program was initially established as a multi-objective plan for flood control, irrigation, power, fish and wildlife, and navigation. Hydropower and flood control aspects of the plan have been developed with success. P-S MBP called for 137 irrigation units to serve over 5 million acres of land, but only 12 percent of the land has been developed for full service and less than 34 percent for supplemental water supplies. Montana has received irrigation development of 47,782 acres of the proposed 967,130 included in the original plan, or about 5 percent.

DESCRIPTION OF PHASE 3
(Virgelle-Milk Canal)

Phase 3 was formulated to provide water to users that would otherwise experience water shortages after Phase 2 is implemented (see Table 4.1). These include the landowners with junior water rights, the Fort Belknap Reservation, Bureau of Land Management stockwater ponds, Bowdoin National Wildlife Refuge, new users along the proposed Virgelle-Milk Canal (private and on Rocky Boys Reservation), and communities along the Milk River.

Three canal capacities were evaluated: 230-, 200-, and 175-ft^3/s. A 230-ft^3/s canal would provide water to all of the above users, so it is the "Preferred Canal Alternative". A 200-ft^3/s canal would meet the needs of users except for private landowners along the canal, while a 175-ft^3/s canal would deny private landowners along the canal as well as the Rocky Boys Reservation.

The DNRC and Milk River irrigators are considering leasing storage in a proposed reservoir in Alberta as an alternative source of supply, as mentioned above. This report focuses only on plan selection for the canal alternative for Phase 3, since the Canadian reservoir is beyond the scope of this study. Planning documents were prepared for Phase 1 and 2 by the responsible entities, as were the NEPA compliance documents. NEPA compliance for Phase 3 will be done with a Planning Report/Draft Environmental Statement (PR/DES) that will be prepared when the PFWD is finalized.

Virgelle-Milk 230-ft^3/s Canal Alternative (Preferred Canal Alternative)

Features of 230 ft^3/s Canal Alternative

Main features of the 230 ft^3/s Canal Alternative would be the pumping plant, canal, distribution and drainage facilities for canalside irrigation (private irrigation and on the Rocky Boys Reservation) and drainage facilities for lands irrigated with junior water rights.

Pumping Plant.--An infiltration gallery pumping plant with 230-ft^3/s capacity would be located 1/2 mile upstream of Boggs Island on the Missouri River. A 66-inch diameter discharge line 1,500 feet long would convey water from the pumping plant to a surge tank on top of the bluff that parallels the river at this point, a static lift of 200 feet. A system to backflush sediment from the gallery would be included in the design.

The infiltration gallery would consist of a plot (660 feet by 310 feet) excavated from the bottom of the river and filled with gravel. Well screens would be laid horizontally in the gravel bed. Water would be drawn from the river bottom and filtered through the gravel, eliminating the transport of weed seeds, a primary concern of the residents in the canal area. This design would also have little effect on the fishery after construction, as the water velocity at the infiltration gallery would be less than .02 ft/s.

The pumping plant would be located in a segment of the Missouri River designated as part of the National Wild and Scenic River System , which preserves the river in its free-flowing condition. The segment of the river from Fort Benton to Coalbanks Landing is managed from bank-to-bank by the Bureau of Land Management and the Montana Department of Fish, Wildlife and Parks (see Figure 4.3). Downstream of Coalbanks Landing, the river is managed from rim-to-rim. This means upstream of Coalbanks Landing there can be no visual intrusions from bank-to-bank of the river. Downstream of Coalbanks Landing, visual intrusions are even more strict: no visual intrusions from rim to-rim of the bluffs.

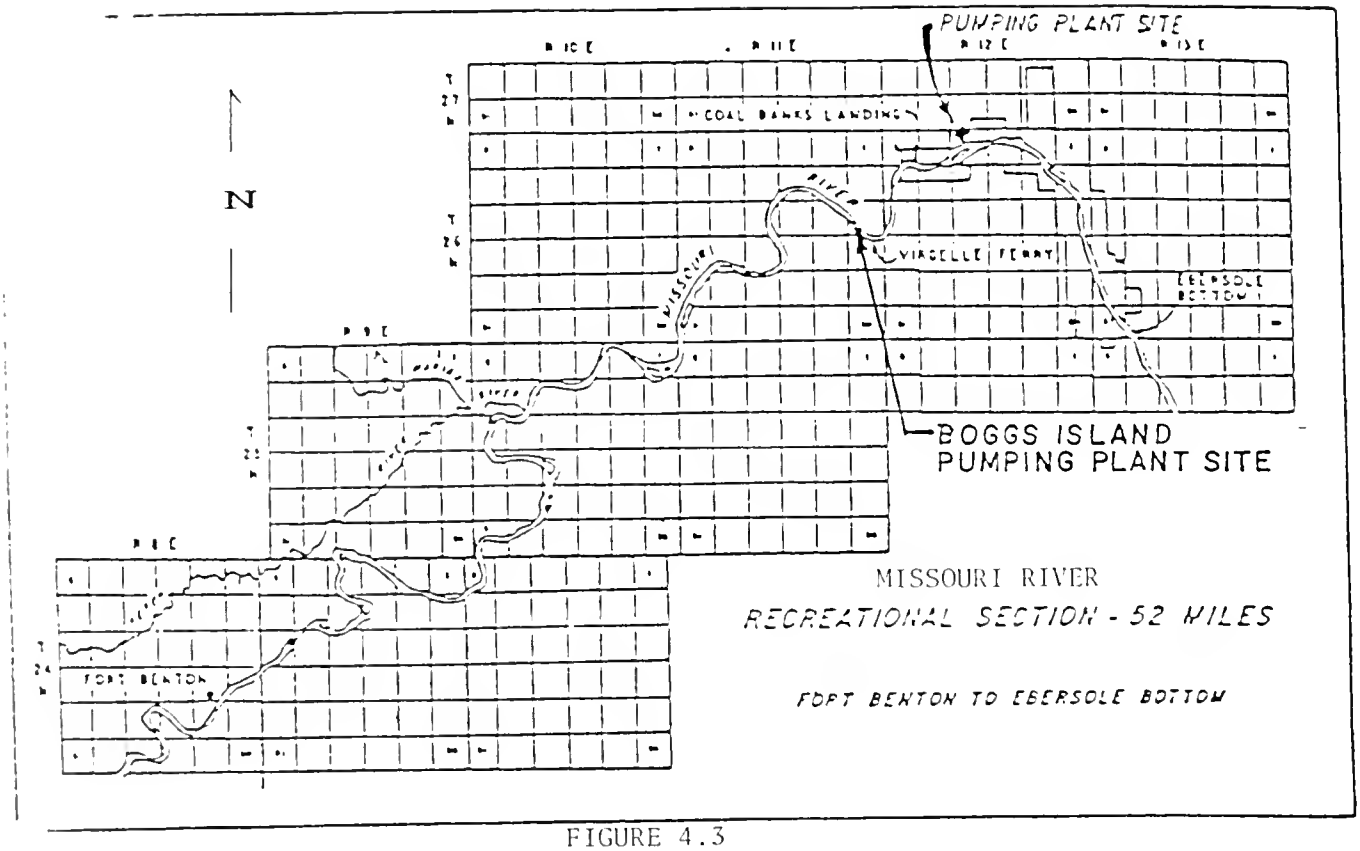

PUMPING PLANT SITE
R 10 E
R 11 E
R 12 E
R 13 E
T 27 N
T 26 N
T 25 N
T 24 N
N
COAL BANKS LANDING
MISSOURI RIVER
VIRGELLE FERRY
EBERSOLE BOTTOM
FORT BENTON
BOGGS ISLAND
PUMPING PLANT SITE
MISSOURI RIVER
RECREATIONAL SECTION - 52 MILES
FORT BENTON TO EBERSOLE BOTTOM

FIGURE 4.3

The proposed site for the pumping plant is upstream of Boggs Island in the section of the river managed bank-to-bank. The plant would be 80 feet from the north bank of the Missouri River behind an existing railroad embankment. Except for electrical transmission lines and the surge tank on the bluff behind the plant, facilities would be screened from on the river. This location would also reduce noise audible to recreationists.

Reclamation considered four possible pumping plant sites and three designs before deciding on the infiltration gallery design at the site near Boggs Island. The infiltration gallery design was selected because it would prevent the transport of weed seeds, cause little fish loss, minimal visual intrusion, and because of its lower O&M cost. The Boggs Island site was selected to avoid impacts to recreation and the fishery.

An open forebay pumping plant design was not chosen at Virgelle because it would have violated visual standards in the area of the river most favored by floaters. The design might have been acceptable at either of the Boggs Island sites where visual standards are less restrictive, but the open forebay plant could transport weed seeds and would cause losses of fish.

A submerged intake pumping plant design, drawing water directly from the river was also considered. The intake system would consist of multiple surface water intake screens placed 2 feet above the river bottom. The screens would be cylindrical with a 2-foot diameter. The plant would be built mostly below ground; only the tops of the electric motors, the switchyard and electrical transmission lines would have been visible from the river. Unfortunately, this design would have the highest O&M cost due to the annual precautionary removal of intake screens to prevent damage from ice jams that frequent the Missouri in winter. The screens also could prevent the transport of weed seeds.

Canal.--Four canal routes were evaluated in the Virgelle-Milk Alternative (see "Canal Routes and Plans Dropped from Consideration" at the end of this chapter). The proposed route would follow the existing Burlington Northern Railroad line right-of-way (ROW) most of the way from the Missouri to the Milk (Figure 4.4). This route was selected because it

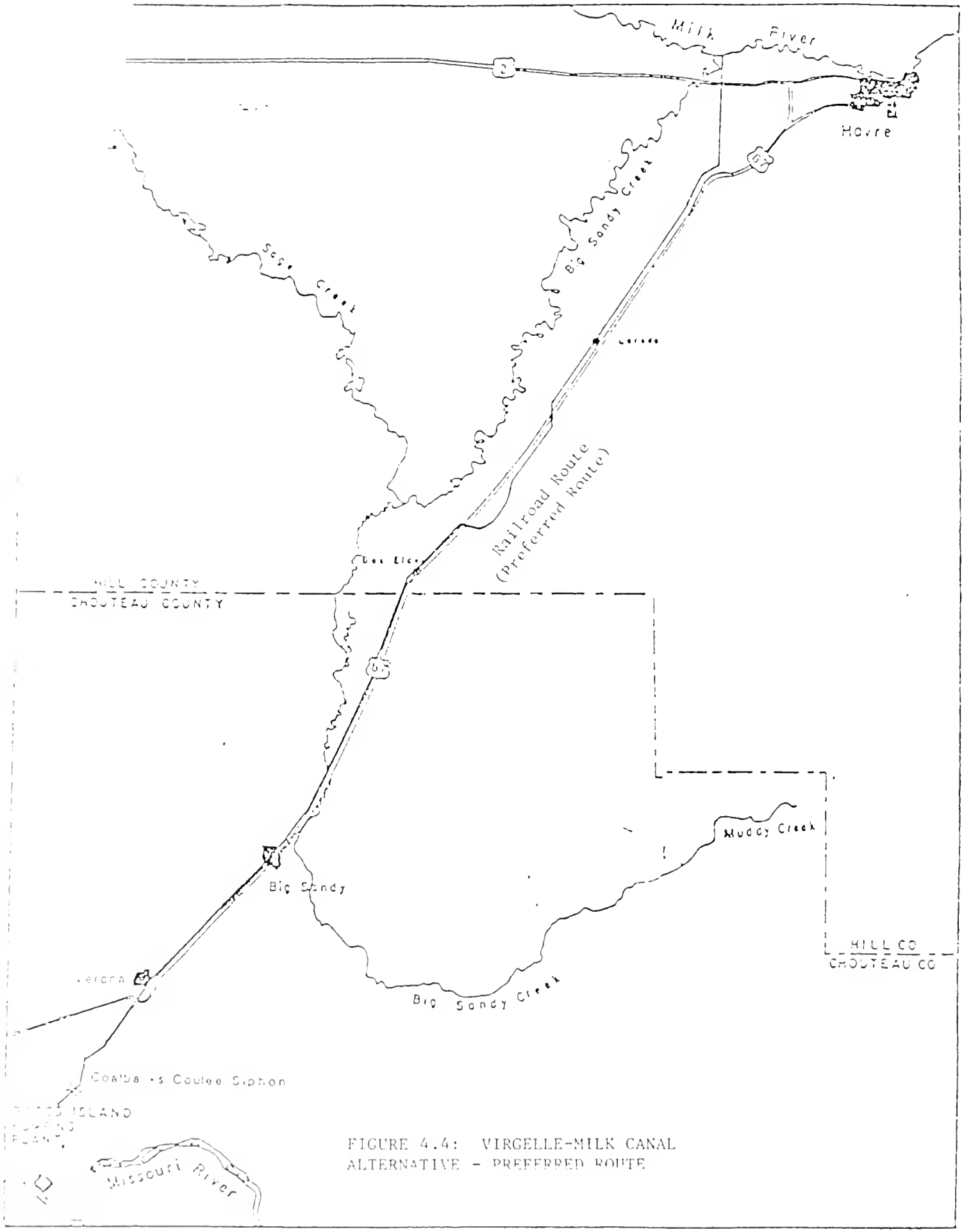


FIGURE 4.4: VIRGELLE-MILK CANAL ALTERNATIVE - PREFERRED ROUTE

would cause the least disruption to the local residents and would have the least impact on the environment.

The canal would be 46 miles long and require 5 siphons, along with 11 concrete drop structures. The canal would be about 12 feet wide at the bottom, 42 feet wide at the top, and 7-1/2 feet deep. A total of 35 canal crossings would be required to provide access to local dryland farm operators. The canal's terminal drop structure into the Milk River would require 850 feet of 60-inch diameter pipe, with the water being emptied into an energy-dissipating stilling basin. About 500 feet of channel would convey the water to the river, 100 feet of which would be protected by riprap. The total drop was estimated at 70 feet. The potential for including a small powerplant at the drop will be evaluated in the Planning Report.

Electrical transmission facilities would probably be provided by a 69-kilovolt line from a substation at Big Sandy to the pumping plant (a distance of 16 miles). An auto transformer would be required at the pumping plant. The Hill County Electric Cooperative is presently interested in sharing in the cost of the substation and distribution line, but will probably begin construction of its own facilities in the next year or two.

One of the primary concerns of Big Sandy area residents is that a canal through the area would increase seeps occurring in this dryland area. Three methods of controlling seepage from the canal were evaluated in the canal design:

1. No lining with toe drains installed as needed along both sides of the canal to collect seepage: drain water would be pumped back into the canal.

2. Membrane lining, with toe drains installed as needed in areas with high water tables (the toe drains would protect the lining when the canal has no water).

3. Compacted-earth lining with toe drains installed as needed in areas with high water table.

Of the three lining options, the membrane lining method was selected to ensure that seeped areas would not increase. No lining with toe drains was the least costly, the compacted-earth lining the most costly.

Canalside Irrigation Facilities.--About 6,600 acres would be irrigated along the Virgelle-Milk Canal (3,300 acres on the Rocky Boys Reservation and 3,245 acres of private land). Isolated areas and fields smaller than 20 acres were not considered economical to serve and typically were not included in the project. It was assumed the land would be sprinkler-irrigated because most irrigable land is located above the canal and is widely scattered.

The lateral system for canalside irrigation was sized according to a peak delivery rate of 1 ft^3/s per 48 acres, derived by using a 2-inch/foot waterholding capacity of the soil and a 4-foot root zone. Sprinklers would operate 22 hours daily, with farm efficiency assumed to be 75 percent. The average annual crop irrigation requirement (CIR) for the project area was determined to be 14.83 inches of water.

Estimated distribution and drainage system costs are as follows:

Summary of Costs

Feature	Rocky Boy's Reservation Construction Costs (3,300 acres)	Private Irrigation Construction Cost (3,245 acres)
Pipe Laterals, Pumps and Electric Transmission	$4,800,000 1/	$3,700,000 1/
Drainage	3,400,000 2/	3,900,000 2/
Total	$8,200,000	$7,600,000

1/ Includes 10 percent unlisted items, 25 percent contingencies, 30 percent indirects.
2/ Based on $51,000/mile ($31,944/mile for labor and materials, 10 percent unlisted items, 25 percent contingencies, and 25 percent indirects.)

Drain spacing requirements were determined for individual parcels of land. About 136.5 miles of drains would be needed (66.5 miles on the Rocky Boy's Reservation and 70 miles on private land). Reclamation experience on other projects show these drains would be needed from 5 to 30 years after the beginning of irrigation.

Drainage Facilities for Junior Water Rights Land.--Drain spacing requirements were also determined for all land irrigated outside of the Milk River irrigation districts. About 540 miles of drains would be required on the 25,000 acres irrigated under these junior water rights. Based on Reclamation experience, these drains would be installed over the next 40 years as needed.

Mitigation.--The U.S. Fish and Wildlife Service (USFWS) estimated 288 acres of native rangeland would be affected by construction of the Virgelle-Milk Canal. To mitigate loss of this habitat, about 362 acres of cropland would be reseeded within the rights-of-way (ROW) to create new rangeland. Mitigation for canal impacts would therefore be accomplished within the ROW. Since these costs are included in canal construction, there is no separable cost for mitigation. (See "Coordination with USFWS" in Chapter 6 for details.)

The proposed irrigation of canalside lands (including the Rocky Boys Reservation) would cause the loss of 1,315 acres of native range. Recommendations to manage part of the Lonesome Lake area, about 5 miles northwest of Big Sandy, have been developed (Chapter 6). The area is presently grazed under lease from BLM. As the Federal Government owns 14,596 acres around Lonesome Lake, no land need be acquired, although some grazing rights might have to be purchased. Management costs have not yet been determined but are assumed to be relatively minor compared to other project costs.

Effects of 230 ft^3/s Canal Alternative

Water Supply.--Phase 2 was assumed to be in place prior to construction of the Virgelle-Milk Canal. The Milk River Project Irrigation districts

and contract pumpers should have enough water after Phase 2 is implemented. Enforcement of water rights in the basin will improve the districts' water supply even more (see Table 4.1). Data from measuring devices installed as part of Phase 2 will be used to check the projected water savings.

The Virgelle-Milk 230 ft^3/s Canal was sized to provide water for the remaining needs in the basin:

Landowners with junior water rights
Fort Belknap Reservation
Municipalities
Bowdoin National Wildlife Refuge
BLM stock ponds (on tributaries)
Canalside landowners (Rocky Boys Reservation and private irrigation)

A 230-ft^3/s canal could provide a maximum of 14,100 acre-feet per month. The landowners with junior water rights, Fort Belknap, and canalside landowners would receive a full water supply, defined as a water shortage not to exceed 50 percent in any 1 year or 100 percent in any 10-year period (see Table 4.3).

Table 4.3
DEMAND AND SHORTAGES AFTER PHASE 3 IS IMPLEMENTED

	Average Annual Demand (acre-feet)	Average Annual Water Shortage (%)	Maximum Water Shortage (1984) (%)	10-Year Total % Shortage
Districts and Contract Pumpers 1/	299,600	3	13	68
Landowners with Junior Water Rights	44,400	4	50	92
Fort Belknap Reservation	56,300	3	50	92
Canalside	10,300	1	50	92

1/ District and contract pumpers are not provided water under Phase 3. Their shortages are reduced to within Reclamation shortage guidelines through implementation of Phases 1 and 2.

The average monthly delivery would be divided among the users as follows during the 6-month irrigation season:

Water User	Average Delivery, Virgelle-Milk 230 ft^3/s Canal (1,000 acre-feet) April 1/	May	June	July	Aug	Sept	Oct 1/	Average Annual	% of Total
Fort Belknap Reservation	0.0	0.0	0.3	0.9	2.3	0.3	0.0	3.9	8
Landowners with Junior Water Right	0.1	0.6	0.9	4.2	1.2	0.3	0.1	7.3	15
Canalside Landowners	0.0	1.3	3.2	3.7	3.1	1.0	0.2	12.3	26
BLM	2.7	4.8	0.0	0.0	0.0	0.0	0.0	7.5	16
Lake Bowdoin	4.0	3.0	2.7	0.0	0.0	6.1	0.0	15.7	34
Municipalities				0.2	0.2			0.4	1
Total	6.8	9.7	7.1	9.0	6.8	7.7	0.2	47.1	100

1/ Pumping plant only operates half of month.

During the dry years of the study period, the diversions would be:

Water User	April	May	June	July	Aug	Sept	Oct	Average Annual	% of Total
	(1,000 acre-feet)								
Fort Belknap Reservation	0.0	0.1	2.4	2.5	4.7	0.3	0.0	10.0	15
Landowners with Junior Water Rights	0.6	4.2	8.0	8.3	4.2	0.1	0.0	25.4	37
Canalside Land	0.0	2.0	3.3	3.3	2.6	0.5	0.0	11.7	17
Lake Bowdoin	4.0	2.9	0.0	0.0	0.0	6.1	0.0	13.0	19
BLM	2.2	4.9	0.0	0.0	0.4	0.0	0.0	7.5	11
Municipalities					0.4			0.4	1
Total	6.8	14.1	13.7	14.1	12.3	7.0	0.0	68.0	100

Environmental Effects.--

Fish and Wildlife.--

The pumping plant (with a capacity of 230 ft^3/s) would annually withdraw up to 68,000 acre-feet of water from the Missouri River. The intake would be an infiltration gallery that, once in place, would have no significant effect on aquatic species. Construction would temporarily disturb the river bottom and the water column, causing impacts like increased turbidity. Standard construction safeguards and the proper timing of construction activities would minimize these effects.

Pumping plant electrical facilities would incorporate design considerations that would minimize the possibility of electrocuting raptors as detailed in Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1981 (Olendorf, 1981).

Canal construction would necessitate the crossing of 11.9 miles of native range, equal to 288 acres. By seeding cropland, land within the railroad route ROW, 362 acres of "new" rangeland would be created. Mitigation for habitat lost to canal construction would be accomplished within the ROW required for the canal.

Irrigation of canalside land would cause the loss of 1,315 acres of native rangeland. It has been proposed that the managment of part of the Lonesome Lake area would provide compensation rangeland losses. As most of this area is Federal, no land acquisition would be required, so the only costs would be with managing the grassland areas involved.

The Preferred Plan would provide up to 16,000 acre-feet of water to the Bowdoin National Wildlife Refuge. Some water would have to be delivered in April, May and September, outside the normal irrigation season. The USFWS has stated they will accept delivery at this time.

This water would serve to freshen refuge pools, and restore waterfowl production to normal levels.

Endangered species in the area include peregrine falcon, black-footed ferret and bald eagle. The piping plover, known to nest along the shoreline of Nelson Reservoir, is listed as threatened. Consultation with the USFWS will continue through development of all three phases of the project to ensure that threatened or endangered species are not affected.

Water Quantity

The recommended instream flow requirements according to DNRC for the Missouri River at the Virgelle gauge are:

Use	Recommended Streamflow	Period
Paddlefish	14,000 ft^3/s	May 19 - July 5
Side Channels	5,400 ft^3/s	June 1 - August 31
Riffle Areas	4,305 ft^3/s	Yearlong
Goose Nesting	5,571 ft^3/s	March 15 - June 1
Recreation	7,470 ft^3/s	May 15 - July 15
Recreation	5,150 ft^3/s	July 15 - November 15
Channel Stability	22,600 ft^3/s	16 days between March 15 and July 15

Totaling these requirements and allowing for overlapping periods of time yields the following average monthly flow requirement in ft^3/s. Note that the channel stability requirement was not included in the average monthly requirements because it is needed for only a short time, varying over a 4-month period.

April	May	June	July	August	September	October
5,571	9,274	14,000	7,455	5,400	5,150	5,150

Effects of the project on the capability of the Missouri River to meet instream flow requirements for the 1936-1985 period are listed in Table 4.4. The preferred plan would release water from Lake Elwell (Tiber Dam) to replace the water diverted to the Milk River. Lake Elwell was originally designed to provide 228,700 acre-feet/year firm yield to the Milk River Project, none of which is being used. Since the maximum yearly impact to the instream flow requirements is 73,252 acre-feet, Lake Elwell would have sufficient water to compensate.

Table 4.4 - Impacts to Missouri River Instream Flow Requirements Due to Virgelle Canal Diversion for the Historic Period of 1936 through 1985

	April	May	June	July	August	September	October
Recommended Average Instream Flow	5,571	9,274	14,000	7,455	5,400	5,150	5,150
Average Missouri River Flow	10,050	13,390	21,120	11,550	8,434	7,074	5,294
Average Project Diversion	113	162	118	150	113	128	3
Minimum Missouri River Flow	6,708	6,903	4,646	4,027	4,534	3,990	8,057
Maximum Project Diversion	113	235	228	235	205	118	0
Diversion from Tiber Reservoir							
1. With Average Missouri River Flow	0	0	0	0	0	0	0
2. With Minimum Missouri River Flow	0	235	228	235	205	118	0

Water Quality. - Representative sites of major land bodies in the Milk River, Big Sandy Creek and Rocky Boy's Reservation area were analyzed to a depth of 10 feet to determine the potential to affect water quality from the introduction of soluble trace elements. Samples were collected from major soil horizons, with a 6-inch minimum sample zone. The samples were analyzed in a laboratory to determine if 25 trace constituents/metallic elements were present in detectable concentrations. Objectives of this initial screening were to identify trends in data correlation between various elements and soil types, and to locate potential problem areas needing further analysis. After reviewing results of the analyses, selected sites were resampled because certain elemental concentrations exceeded expected

concentrations of northern plains soils. The resampling and analysis found concentrations of iron, manganese, nitrate, and selenium exceeding EPA drinking water standards. These concentrations were found only on scattered sites on glacial till and alluvium, and thus were considered unrepresentative of most water in the project area, a conclusion supported by the water-soluble analysis which showed few isolated sites with high concentrations that would probably not seriously impair the use of irrigation return flows.

Further, irrigation on water-soluble trace element concentrations would be limited on a land classification basis, and by factors like drainage and slope, which would eliminate most till lands from the project. Data indicates remaining lands would not cause any significant increase in concentrations from return flows.

Five surface soil sites representative of diverse conditions were sampled for pesticides. The sites included dryland, irrigated, return flow surface drain and wetland (Bowdoin National Wildlife Refuge) areas. Pesticide analysis was an organic scan for farm chemicals used in the area. Samples were collected during three sampling periods (April, June, and October) in order to ensure detection of the compounds during water application, plant uptake and runoff from irrigation and storm events. Laboratory analyses indicated all pesticide concentrations except Picloram (Tordon), ranging from 1.0 micro grams/gram (ug/g) of Triallate at the Laredo nonirrigated site to 30.6 ug/g for Dicamba (Banvel) at the Laredo irrigated site (see the Hydrology Appendix). All October samples were below detection, indicating persistence in the soil (and drain water) to be nonexistent within a growing season. Thus, pesticide impacts to water quality from project development would be insignificant.

Cultural Resources. - A Class III cultural resource inventory was conducted by archeological consultants. Fourteen prehistoric and historic sites, of which three were recommended as eligible for listing on the National Register of Historic Places, will be affected by the canal route. Two sites, including stone circles with rock cairns and cultural

material scatters, are in a direct line with the intake of the river, within the first mile. Parts of the other site, the Great Northern Railroad, were previously recorded as a historic site (24CH585 - also designated 24HL869 in Hill County), has been found eligible by the Montana State Historic Preservation Office (SHPO). The railroad has been designated eligible for the National Register as a historic district. The proximity of the canal route to the railroad will result in visual effects to the eligible district, as well as physical effects wherever it crosses the railbed.

Cultural resources on access roads, borrow areas, construction staging areas, unplowed lands to be irrigated, and areas were the canal route was changed from the 1985-86 cultural resource surveys, will be inventoried. Reclamation will consult with SHPO on the eligibility of any finds and on possible mitigation.

Social Effects. - Social effects of project alternatives were evaluated using the following social factors:

1. Farms crossed by canal.
2. Concerns about canal seepage and weed spread.
3. Employment.
4. Population change - during construction and resulting from project.
5. Income - during construction and resulting from project.
6. Housing during construction.
7. Project costs.
8. Public facilities and services during construction.
9. Indian acreage irrigated by plan.

A summary matrix of social effects is provided in the next chapter, along with a table summarizing the results of a Multi-Attribute Tradeoff System (MATS) analysis made on five social factors.

Canal Impacts. - Several social concerns revolve around the number of farms severed by the canal, canal seepage, and the spread of weeds. The railroad route was suggested by residents in the project area since it that would disrupt the fewest farming operations. The route would require

crossing of another 19 farms beyond those crossed by the railroad. A total of 35 bridges would be built at existing railroad or natural crossing sites to mitigate the potential long-term disruption. There would be a certain amount of inevitable inconvenience and disruption during the construction period.

The canal will be lined with plastic membrane lining. According to a 1987 Reclamation study, seepage from the canal will be so insignificant that it will not be detectable when superimposed on the natural groundwater (Reclamation, 1987). Where groundwater is naturally above the canal grade, toe drains will be used to lower it enough to prevent damage to the lining when the canal is not in use.

Potential transfer of weed seeds from the Missouri River and weed control measures along the canal right-of-way are prime concerns. Reclamation is planning an infiltration gallery pumping plant intake for the project which would effectively eliminate the transport of weed seeds. A number of proven techniques could be utilized to control weeds along the canal, including spraying after earthwork is done, replanting the ROW with native grasses, and periodically spraying and mowing grass waterways.

Population. - Population changes due to the project would accrue only during the 2-year construction period. The total population increase is estimated to peak at about 290 people, based on MATS (see Table 5.2). Project construction would take place in Hill and Choteau Counties. Several communities in the area could absorb the extra people: Great Falls, Havre, Fort Benton, Chinook, or Big Sandy. It is assumed that residual agricultural jobs created by the project would be absorbed by the unemployed and underemployed in the area, with no permanent population increase.

Employment and Income. - MATS projects that direct onsite employment would peak at about 180 jobs, of which about 70 would be available to Fort Belknap and Rocky Boys Reservation tribal members. Annual adjusted direct earnings (earnings less welfare losses) during the construction period would be about $6.8 million. It is estimated that about $2.7 million of these earnings would accrue to tribal employees.

Average annual increased agricultural income (both direct and indirect) resulting from the project would be about $3.2 million. It is estimated that about $2.2 million of this income would accrue to tribal members.

Average annual agricultural employment would increase by about 45 full-time jobs. About 30 percent of these jobs would be on tribal lands.

Housing. - It is estimated that about 60 additional housing units will be required during the construction period, assuming that 50 percent of the imported labor will bring temporary housing with them. As noted above, there are several communities which could absorb the additional demand without undue stress. Most counties in the area have vacancy rates around 20 percent as of the 1980 census, and it can be assumed that rates are at least as high as of this writing, due to the continued depressed state of rural economies. No additional housing needs are anticipated following the construction period.

Facilities and Services. - The temporary population increase would not create an undue burden on most existing facilities and services. However, the area is typical of rural areas in this region, in which provision of social and medical services is difficult due to distances traveled and restricted social and cultural opportunities. Therefore, increased demand for medical and dental facilities could be anticipated during the 2-year period. School systems in the area should have capacity to accommodate the expected peak of about 100 additional students, due to long-term population losses in most areas of the region.

Project Costs. - Construction and operation of facilities under the Preferred Plan would impose increased costs on area irrigators. Total annual equivalent economic costs are estimated at about $5.4 million, with about $1.5 million of this amount accruing to the Rocky Boys and Fort Belknap Reservations (see the "Economic Analysis" below). However, the reservation capital costs would be deferred under the Leavitt Act of 1932, as long as the land remains in Indian ownership.

Indian Lands. - The Preferred Plan includes the irrigation of 9,850 dryland equivalent acres on the Fort Belknap Reservation and 3,300 acres on the Rocky Boy's Reservation.

Costs of 230 ft^3/s Canal Alternative

Construction Costs. - The January 1987 costs for the Virgelle-Milk 230-ft^3/s canal are shown on Table 4.5. The total of $88,000,000 includes $44,000,000 for the pumping plant and canal, $16,000,000 for distribution and drainage systems for canalside land, and $28,000,000 for drainage facilities for land irrigated with junior water rights. Construction of the drains will be deferred until needed.

Operation, Maintenance and Replacement Costs. - The annual OM&R for a 230-ft^3/s pumping plant at Boggs Island and 47 miles of canal to the Milk River is estimated to be $130,000.

Project energy requirements include 14,160,000 kWh for pumping an average of 47,100 acre-feet per year from the Missouri River and 2,730,000 kWh for providing 10 feet of total dynamic head (TDH) at each irrigation pivot for canalside lands. This energy would be provided at Pick-Sloan Missouri Basin rate of 2 1/2-mills/kWh.

In addition, the operators would pay for energy to provide 45 psi to each sprinkler at a rate of 51 mills/kWh (the average rate charged by Montana electric cooperatives).

The OM&R costs for the canalside irrigation distribution systems were estimated on per-acre costs based on similar OM&R studies.

Table 4.5

CONSTRUCTION COST FOR VIDGELLE-MILK 230 ft^3/s CANAL ALTERNATIVE

(Preferred Alternative)

(January 1987 Prices Rounded)

Pumping Plant	$ 6,066,000
Cofferdam	274,000
Discharge Line and Surge Protection	1,406,000
Canal	22,871,000
Terminal Drop	625,000
Siphons	3,419,000
Drop Structures	696,000
Toe Drains	715,000
Canal Crossings	1,788,000
Transmission Facilities	1,930,000
Cross Drainage	2,295,000
Mobilization	2,000,000
Subtotal (Rounded)	$44,000,000 1/
Canalside Distribution System 2/	8,500,000
Drainage Systems	
- Canalside 2/ 3/	7,300,000
- Landowners with Basin Junior Water Rights 4/	28,000,000
Total (Rounded)	$88,000,000

1/ Right-of-way costs are included in the cost of facilities. Also includes 10 percent unlisted items, 25 percent contingencies, 30 percent indirects.

2/ Includes private irrigators and Rocky Boys Indian Reservation.

3/ To be deferred 5-30 years.

4/ To be deferred 1-40 years.

Item	Annual Cost
Canal and Pumping Plant	$ 130,000
Energy (main pumping plant)	35,000 1/
Subtotal	$ 165,000
Rocky Boys and Canalside	
Irrigation System	$ 138,000
Energy (Distribution System)	7,000 2/
Subtotal	145,000
Total (Rounded)	$ 310,000

1/ 47,100 acre-feet x 220 foot TDH x 1.025 = 14,160,000 kWh at 2 1/2-mills .75 efficiency

2/ 2,730,000 kWh to provide 10 feet of TDH at pivot at 2 1/2-mills

Economic Analysis of 230 ft^3/s Canal Alternative

The economic analysis for the 230-ft^3/s Virgelle-Milk Canal Alternative is displayed in Table 4.6. More detailed explantion of the derivation of benefits is presented in Attachment 2 at the end of this report.

Construction costs include the canal, pumping plant and distribution system for canalside irrigation based on January 1967 costs. The total investment costs were converted to an annual equivalent based on 8-5/8 percent interest and a 100-year period of analysis.

Drainage needs were evaluated for canalside lands and lands irrigated with junior water rights. With good management and properly designed onfarm irrigation systems, it is expected that drainage requirements for canalside acres can be deferred 5 years and then be installed over the following 25-35 years. Drainage installations on lands with junior water rights will begin the first year appropriation areas are available for the project and continue over the next 40 years.

Opportunity cost of power is the marginal cost of project pumping and was computed as the variable cost of replacing power withdrawn from summer users of the Pick-Sloan Missouri Basin Program. The economic cost of power is 22.2 mills per kWh.

Interest during construction was calculated based on 8-5/8 percent compounded annually for a 2-year construction period.

The annual irrigation benefit for a full water supply is estimated to be $142 for each acre (see Attachment 2 for details). Canalside lands are currently dryland farmed. Therefore, the benefit is $469,000/year for irrigating 3,300 acres on Rocky Boys Reservation (3,300 acres x $142/acre) and $461,000/year for irrigating 3,245 acres of private canalside lands (3,245 acres x $142/acre).

This same benefit value was claimed for the 25,000 acres with junior water rights. These lands are presently irrigated; however, when water right

Table 4.6
BENEFIT-COST ANALYSIS
VIRGELLE-MILK 230 ft^3/s CANAL ALTERNATIVE
(Preferred Plan)

(Annual Equivalent Values)

Costs	
Construction 1/	$4,529,000
Drainage 2/	844,000
Interest During Construction(IDC) 3/	399,000
Economic Cost of Energy 4/	333,000
OM&R 5/	313,000
TOTAL Costs	$6,418,000
Benefits	
Irrigation 6/	$5,879,000
Fish and Wildlife (Lake Bowdoin) 7/	122,000
Bureau of Land Management Stockponds 8/	72,000
Unemployment 9/	159,000
Municipal and Industrial	37,000
TOTAL Benefits	$6,269,000
Net Benefits	- $ 149,000
Benefit-Cost Ratio	.98

1/ Construction

Canal and pumping plant $44,000,000 x .08627) 10/	$3,796,000
Canalside Dist. ($3,700,000 x .08627)	319,000
Rocky Boys Dist. ($4,800,000 x .08627)	414,000
	$4,529,000

2/ Drainage

Canalside Drainage ($3,900,000 divided by 25 years x 10.12867 11/ x .66122 11/ x .08627)	$ 90,000
Rocky Boys Drainage ($3,400,000 divided by 25 years x 10.12867 11/ x .66122 11/ x .08627)	79,000
Pumpers ($28,000,000 divided by 40 years x 11.17051 11/ x .08627)	675,000
	$ 844,000

3/ IDC ($52,500,000 construction cost x .088 x .08627) $ 399,000

4/ Energy (16,890,000 kwh x $.0197/kWh) 333,000 5/

5/ OM&R

Canal and Pumping Plant	130,000
Canalside Distribution	68,000
Rocky Boys Distribution	70,000
Energy (18,066,000 kWh x $.0025/kWh)	45,000
	$ 313,000

6/ Irrigation

Rocky Boy's Reservation (3,300 acres x $142/acre)	$ 469,000
Private Canalside (3,245 acres x $142/acre)	461,000
Fort Belknap (9,850 acres x $142/acre)	1,399,000
Junior Water Rights (25,000 acres x $142/acre)	3,550,000
	$5,879,000

7/ Fish and Wildlife

OM&R (12,700 acre-feet x $3.72/acre-foot)	$ 47,000
Energy (12,700 acre-feet x 220' TDH) x	75,000
.75 efficiency	122,000
1.025 x $.0197)	

8/ BLM

OM&R (7,500 acre-feet x $3.72 acre-feet)	28,000
Energy (7500 ac-ft x 220 ac-ft total dynamic head)	
x 1.025 x $.0197	44,000
.75 efficiency	$72,000

9/ Unemployment (52.5 construction cost in $1,000 x $3,023/$1,000,000 $159,000

10/ .08627 is annualization factor at 8-5/8 percent

11/ Deferral factors for drainage

adjudication is enforced, these landowners would have shortages greater than 10 percent in 6 out of 10 years. In 1 out of 10 years, shortages would be over 50 percent. In extremely dry years no water could be provided to landowners with junior rights; the water supply would be only adequate for senior rights. Without an additional water supply to the basin, these lands would probably revert back to dryland.

Even with their reserved water right, the Gros Ventre-Assiniboine Tribes of the Fort Belknap Reservation would require a supplemental supply from the canal to provide a full water supply to 24,425 acres. To determine the benefit for providing this supplemental water, a dryland equivalent acreage was used. (The dryland equivalent is the number of acres that would have to be taken out of production for the remaining acres to have a full water supply). About 9,850 acres would have to be taken out of production to provide a full water supply to the remaining 14,575 acres. The benefit for Fort Belknap Reservation is $1,399,000 (9,850 acres x $142).

The Fort Belknap and Rocky Boys Indian Reservations have been designated as "substantial and persistent" unemployment areas by the U.S. Department of Commerce. Unemployment benefits were estimated on a 75 percent unemployment rate on the reservation, with 50 percent of the unskilled and 30 percent of the skilled construction labor jobs filled by Indians.

The only community indicating interest in municipal and industrial water is Chinook. There is no alternative source for more water, so Chinook requested 400 acre-feet of water from the canal. Benefits, determined by the "use of facilities" method, average $37,000 annually.

Water for both Lake Bowdoin and BLM stockponds would be provided without separable canal capacity. Water for Lake Bowdoin would be provided before and after the irrigation season. Benefits for the USFWS and BLM were based on the incremental energy and OM&R costs.

Total annual equivalent costs are $6,418,000. The benefits associated with these costs are $6,269,000, for a -$149,000 in net annual benefits.

Financial Analysis of 230 ft^3/s Canal Alternative

The payment capacity of the land to be provided a water supply was estimated from typical farm budget analysis with and without the project (see Attachment 2 at the end of this report for details). The computed payment capacity is $19.63 per acre.

This payment capacity is the estimated annual amount the irrigator could pay for repayment of project costs and annual OM&R. The costs of the project and OM&R to be repaid by each water user group were allocated based on average use of facilities. For example, during an average year, 8 percent (3,900 acre-feet) of the total diversion (47,100 acre-feet) would be pumped from the Missouri River for use on the Fort Belknap Reservation. The use of facilities is as follows:

	Average Annual Diversion (acre-feet)
Fort Belknap Reservation	3,900
Landowners with Junior Water Rights	7,300
Canalside (private)	6,150
Canalside (Rocky Boys Reservation)	6,150
BLM	7,500
Bowdoin National Wildlife Refuge	12,700
Town of Chinook	400
Total	44,100

Annual OM&R charges (including energy) for the canal and pumping plant were allocated as shown below and in Table 4.7, based on use of facilities. All water users would pay their share of OM&R.

	Annual O&M&R	
	Total	Per Acre
Fort Belknap Reservation	$ 14,300	$ 1.45
Landowners with Junior Water Rights	26,700	1.07
Canalside Private	22,500	6.93
Canalside - Rocky Boys	22,500	6.82
BLM stockwater ponds	27,300	--
Bowdoin National Wildlife Refuge	57,300	--
Town of Chinook	1,400	--
Total	$172,000	

The total allocated costs are shown below. Costs allocated to Bowdoin National Wildlife Refuge, BLM stockwater ponds, and municipal use are nonreimbursable; there is no separable canal capacity for these functions. The amount to be repaid by the Fort Belknap and Rocky Boys Reservations would be deferred under the Leavitt Act of July 1, 1932, as long as the land remains in Indian ownership. These entities would pay their share of O&M&R energy costs.

Total Allocated Costs for 230 ft^3/s Canal Alternative

	Canal and Pumping Plant	Distribution System	Drainage System	Total
Fort Belknap Reservation	$3,643,000 1/	--------	------	$ 3,643,000
Landowners with Junior Water Rights	6,820,000 2/	--------	28,000,000	34,820,000
Private Canalside Landowners	5,745,000 3/	3,700,000	3,900,000	13,345,000
Rocky Boy's Reservation	5,745,000 3/	4,800,000	3,400,000	13,945,000
BLM Stockwater Ponds	7,006,000 4/	--------	------	7,006,000
Bowdoin National Wildlife Refuge	14,667,000 5/	--------	------	14,667,000
M&I	384,000 6/	--------	------	384,000
Total	$44,000,000	8,500,000	35,300,000	$87,800,000

1/ 3,900/47,100 x $44,000,000
2/ 7,300/47,100 x $44,000,000
3/ 6,150/47,100 x $44,000,000
4/ 7,500/47,100 x $44,000,000
5/ 15,700/47,100 x $44,000,000
6/ 400/47,100 x $44,000,000

It was assumed drains would be funded through a sinking fund established as part of the repayment contract. Irrigators would pay into the fund annually and funds would be used to install drains as needed.

If the landowners with junior water rights repaid their share of the project costs at the $19.63 rate, they would repay the costs in 19 years. If the irrigators were authorized to repay the project costs for 40 years, their annual payment would be $11.55/acre ($6.82 for repayment of project costs, $1.07 for OM&R, and $3.66 for a sinking fund to install drains as needed). This is shown in the following tabulation and on Table 4.7.

Payment Capacity	$ 19.63
minus OM&R	1.07
minus sinking fund for drains	3.66
Total Available for Repayment	14.90

$6,820,000 allocated costs divided by 19 years = $ 359,000/25,000 acres
$6,820,000 allocated costs divided by 40 years = $ 170,500/25,000 acres
$ 6.82/acre

The costs for serving private canalside irrigators exceed the National Economic Development benefit for these acres. Therefore, according to Reclamation criteria, these costs must be funded by a non-Federal entity (see Chapter 5). The payment capacity of private canalside irrigators ($19.63/acre) is not adequate to meet their OM&R costs, but the unpaid balance of these costs will be assumed by the non-Federal entity. Also, this entity will pay the allocated canal pumping plant costs and drainage facilities costs. The following table and Table 4.8 show the derivation of the subsidy per acre required for these lands.

	Per Acre
Allocated Costs	$ 72.77
Drainage Facilities	3.24
OM&R	28.02
Total Charges	$104.03
Available for Repayment	19.63
Subsidy Required	84.40
Total Annual Subsidy	$274,000 (rounded)

Table 4.7

VIRGELLE-MILK 230 ft^3/s CANAL ALTERNATIVE YEARLY

PAYMENT CAPACITY AND REIMBURSABLE COSTS

(40-Year Repayment Period)

	Payment Capacity $/Acre	O&M $/Acre	Available for Repayment $/Acre	Reimbursable Costs (000's)	Water Charges $/Acre/40 Year
Fort Belknap Tribes	19.63	1.45 1/	18.18	3,643 1/	Deferred
Landowners with Junior Water Rights	19.63	1.07 1/	18.56	34,820 1/	11.55 4/
Canalside - Private	19.63	27.89 2/	- 8.26	13,345 1/	5/
Canalside - Rocky Boys	19.63	28.03 3/	- 8.40	13,945 1/	Deferred

1/ Derivation shown on page 4-44

2/ Canal O&M $ 6.93/acre
Dist. O&M 20.96/acre
Total $27.89/acre

3/ Canal O&M $ 6.82/acre
Dist. O&M 21.21/acre
Total $28.03/acre

4/ Derivation shown on page 4-45

5/ The O&M costs beyond the ability of the irrigators to pay and the distribution system cost will be paid by a non-Federal entity.

Virgelle-Milk 200-ft^3/s Canal Alternative

A 200-ft^3/s canal would serve all water users except the 3,300 acres irrigated by private canalside landowners. This alternative provides the maximum net benefit for the Federal investment and enhances the social well-being of the Gros Ventre-Assiniboine and Chippewa-Cree Tribes (see Chapter 5 for details).

Feature of 200-ft^3/s Canal Alternative

The pumping plant and canal would be in the same location; the capacity would be reduced to 200 ft^3/s. Distribution and drainage systems for private canalside lands would not be constructed.

Mitigation

Native rangeland affected by canal construction would be mitigated by reseeding within the canal right-of-way to create new rangeland. To mitigate for loss of native rangeland on the Rocky Boy's Reservation, a portion of Lonesome Lake would be managed for wildlife.

The USFWS, as part of the planning process, was asked to evaluate different canal routes for this report. It is assumed that the impacts of constructing the 200-ft^3/s canal would be no worse than for the 230-ft^3/s canal as the planned ROW width is the same.

Effects of 200-ft^3/s Canal Alternative

Water Supply.--The 200-ft^3/s canal would provide the same water supply to the Milk River irrigators and Rocky Boys Reservation as the 230-ft^3/s canal. Shortages to the Milk River irrigators would be the same as shown on Table 4.5. Private canalside irrigators would not be served.

Environmental Effects.--Environmental concerns about canalside irrigation would be avoided in this alternative. Other environmental concerns would be the same as, or slightly reduced from, the Preferred Plan. (See environmental discussion above for the larger canal.)

Social Effects.--The social effects discussed for the Preferred Plan would be similar for this plan. However, the construction costs of this alternative would be about 13 percent less than that of the Preferred Plan; therefore, impacts on employment, population, income, etc., during the construction period would decrease proportionately. Similarly, the total annual agricultural income resulting from the plan would be about 8 percent less than that of the Preferred Plan, with a commensurate reduction in general economic activity in the region. Social effects are summarized in Table 5.2.

Costs of Virgelle-Milk 200-ft^3/s Canal Alternative

Total costs (January 1987 prices) for the 200-ft^3/s Canal Alternative would be $77,200,000 as shown below.

Pumping Plant and Canal	$ 41,000,000
Drainage Facilities for Landowners with Junior Water Rights 1/	28,000,000
Rocky Boys Reservation (3,300 acres)	
Distribution System	4,800,000
Drainage Facilities 2/	3,400,000
	$ 77,200,000

1/ To be deferred 1-40 years.
2/ To be deferred 5-30 years.

Operation, Maintenance and Replacement (OM&R) Costs

The annual OM&R costs are estimated to be $126,000. In addition, the pumping plant would require an average of 12,860,000 kwh of energy per year at 2 -mills per kWh, or $32,000 (40,950 acre-feet x 314 kWh/acre-feet x 2.5 mills/kWh).

Economic Analysis of 200-ft^3/s Canal Alternative

Derivation of the annual equivalent costs and benefits is shown in the 230-ft^3/s Canal Alternative. For the 200-ft^3/s Canal Alternative, the annual benefits ($5,782,000) would exceed the annual costs ($5,475,000), resulting in a benefit-cost ratio of 1.06 (see Table 4.8).

Table 4.8

BENEFIT-COST ANALYSIS
VIRGELLE-MILK 200-ft^3/s CANAL ALTERNATIVE

(Annual Equivalent Values)

Costs	
Construction 1/	$ 3,951,000
Drainage 2/	675,000
IDC 3/	348,000
Economic Cost of Energy 4/	271,000
OM&R 5/	230,000
Total Costs	$ 5,475,000
Benefits	
Irrigation 6/	$ 5,418,000
Fish and Wildlife 7/	119,000
BLM 8/	70,000
Unemployment 9/	138,000
Municipal and Industrial	37,000
Total Benefits	$ 5,782,000
Net Benefits	$ 307,000
Benefit-Cost Ratio	1.06

1/ Construction

Canal and Pumping Plant ($41,000,000 x .08627 annualization factor)	$ 3,537,000
Rocky Boys Dist. ($4,800,000 x .08627)	414,000
	$ 3,951,000

2/ Drainage

Pumpers ($28,000,000 divided by 40 years x 11.17051 10/ x .08627)	$ 675,000
Rocky Boy's ($3,400,000 divided by 25 years x 10.12867 10/ x .66122 10/ x .08627)	79,000
	$ 754,000

3/ Interest during construction ($45,300,000 x .088 x .08627) $ 348,000

4/ Energy ($\frac{45,700 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0197}{.75 \text{ efficiency}}$) $ 271,000

5/ OM&R

Canal and Pumping Plant	$ 126,000
Energy $\frac{45,700 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0025}{.75 \text{ efficiency}}$	34,000
Rocky Boys Reservation Distribution System	70,000
	$ 230,000

Footnotes, continued

6/ Irrigation

Junior Water Rights (25,000 acres x $142/acre)	$ 3,550,000
Fort Belknap (9,850 acres x $142/acre)	1,399,000
Rocky Boy's Reservation (3,300 acres x $142/acre)	469,000
	$ 5,418,000

7/ Fish and Wildlife

OM&R (12,700 acre-feet x $3.45/acre-foot)	$ 44,000
Energy (12,700 AF x 220' TDH x 1.025 x $.0197) / .75 efficiency	75,000
	$ 119,000

8/ BLM

OM&R (7,500 acre-feet x $3.45/acre-foot	$ 26,000
Energy (7,500 AF x 220' TDH x 1.025 x $.0197) / .75 efficiency	44,000
	$ 70,000

9/ Unemployment (45.8 x $3,023) $ 138,000

10/ Deferral factors

Financial Analysis of 200-ft^3/s Canal Alternative

The payment capacity was developed as discussed in Attachment 2. The computed payment capacity is $19.63. An annual payment of $12.12 by the landowners with junior water rights would pay annual OM&R ($1.15 per acre), establish a sinking fund for drains ($3.66 per acre), and repay the reimbursable costs ($7.31 per acre) over a 20-year period (see Table 4.9). If the reimbursable costs were paid at a rate of $19.63 per acre ($14.82 for repayment, $1.15 for OM&R and $3.66 for drainage) the repayment period would be 20 years. 1/

Repayment for land in Indian ownership would be indefinitely deferred under the Leavitt Act, as long as the land remains in Indian ownership.

Virgelle-Milk 175-ft^3/s Canal Alternative

Reclamation guidelines require that an alternative be formulated that maximizes the benefits to the nation, referred to as the "National Economic Development" (NED) alternative. The 175-ft^3/s canal alternative, which includes capacity to serve the Fort Belknap Tribes and the landowners with junior water rights, is the NED alternative in this report (see Chapter 5).

Features of 175-ft^3/s Canal Alternative

The pumping plant and canal were sized to serve only the landowners with junior water rights and the Gros Ventre-Assiniboine Tribes. The pumping plant location and canal route would be the same as the Preferred Plan. Mitigation costs would only include reseeding cropland within the canal right-of-way to create new rangeland.

1/ $7,308,900 allocated costs divided by [$14.82 x 25,000 acres = $370,500/year] = 20.

Table 4.9

VIRGELLE-MILK 200-ft^3/s CANAL ALTERNATIVE
YEARLY PAYMENT CAPACITY AND REIMBURSABLE COSTS

	Payment Capacity ($/Acre)	OM&R ($/Acre)	Available for Repayment ($/Acre)	Reimbursable Costs	Water Charges ($/Acre) (for 40 Years)
Landowners with Junior Water Rights	19.63	1.15 1/	18.48	35,309,000 6/	12.12 2/
Fort Belknap Reservation	19.63	1.57 3/	Deferred	3,905,000 4/	Deferred
Rocky Boy's Reservation	19.63	28.58 5/	Deferred	14,357,000 7/	Deferred

---

1/ OM&R - 7,300/40,950 x $162,000 divided by 25,000 acres = $ 1.15/acre

2/ Canal - 7,300/40,950 x $41,000,000 divided by 25,000 acres divided by 40 years = $ 7.31/acre
Drainage - $28,000,000 x .00327 (40 years, 8-5/8 percent sinking fund) = $ 3.66/acre
Canal OM&R $ 1.15/acre

3/ OM&R - 3,900/40,950 x $162,000 divided by 9,850 acres $ 1.57/acre

4/ Canal - 3,900/40,950 x $41,000,000

5/ OM&R
Canal - 6,150/40,950 x $162,000 divided by 3,300 acres = $ 7.37/acre
Dist. - $70,000 divided by 3,300 acres = $21.21/acre

6/ Canal - 7,300/40,950 x $41,000,000 = $ 7,309,000
Drainage 28,000,000
$35,309,000

7/ Canal - 6,150/40,950 x $41,000,000 = $ 6,157,000
Drainage 3,400,000
Distribution 4,800,000
$14,357,000

Effects of 175-ft^3/s Canal Alternative

Water Supply.--The 175-ft^3/s canal would provide the same water supply as the 230-ft^3/s canal to the Milk River irrigators. Private canalside landowners and the Rocky Boys Reservation would not receive a water supply.

Environmental Effects.--Environmental effects associated with the actual construction of the pumping plant and canal would be the same as the Preferred Plan. For example, impacts on historical sites, loss of wildlife habitat in canal ROW, etc., would not change based on utilizing the same ROW width. Impacts caused by irrigating private canalside lands and Rocky Boys Reservation lands would be avoided.

As discussed under the 200-ft^3/s plan, canal routes, rather than capacities, were evaluated by the USFWS. Impacts of the smaller size would be like those of the 230-ft^3/s canal.

Social Concerns.--The social impacts for the 200-ft^3/s canal would be similar to those of the 230-ft^3/s canal. However, the construction costs of this alternative would be about 30 percent less than costs for the 230-ft^3/s canal; therefore, impacts on employment, population, income, etc., during the construction period would decrease proportionately. Similarly, total annual agricultural income resulting from the plan would be about 15 percent less than that of the 230-ft^3/s canal, with a commensurate reduction in general economic activity in the region. (See Table 5.2 in the next Chapter.)

Costs of 175-ft^3/s Canal Alternative

Total construction costs for the 175-ft^3/s Canal Alternative would be $65,000,000. The costs for 175-ft^3/s canal and pumping plant is $37,000,000. The costs for drainage facilities for landowners with junior water rights is estimated as $28,000,000. The drains will be installed as needed over the next 40 years.

Annual OM&R costs are estimated to be $146,000 including 10,927,200 kWh of energy at 2 -mills per kWh, or $26,000.

Economic Analysis of 175-ft^3/s Canal

The annual equivalent costs and benefits were derived as discussed under the 230-ft^3/s Canal Alternative. As shown on Table 4.10, the annual benefits ($5,285,000) exceed the annual costs ($4,510,000) by $785,000, a benefit-cost ratio of 1.17. This alternative results in the maximum net NED benefits and is referred to as the NED Alternative. (See Chapter 5, "Plan Selection" for more details.)

Financial Analysis of 175-ft^3/s Canal

The payment was developed as discussed in Attachment 2. The computed payment capacity for the landowners with junior water rights would be $19.63 (see Table 4.11). Deducting their OM&R of $1.23 per acre and $3.66 for drainage sinking fund leaves $14.74 available for repayment of the reimbursable project costs ($7,800,000). An annual payment of $195,000 ($7.80/acre) would repay the reimbursable costs over a 40-year period. If the junior water right landowners repaid the reimbursable costs at the $19.63 rate, the repayment period would be 22 years. 1/

Repayment for land in Indian ownership would be indefinitely deferred under the Leavitt Act, as long as the land remains in Indian ownership. Interest during construction for the irrigation function is nonreimbursable. Bureau of Land Management and U.S. Fish and Wildlife Service would pay a portion of the OM&R and energy cost - $25,000 and $43,000, respectively.

1/ [25,000 x (19.63 - 1.23 OM&R - 3.66 drainage sinking fund)] = $368,500/year. $7,800,000 reimbursable capital costs divided by $368,500 = 22.

Table 4.10

BENEFIT-COST ANALYSIS
VIRGELLE-MILK RIVER 175-ft^3/s CANAL ALTERNATIVE

(Annual Equivalent Values)

Costs	
Construction 1/	$3,192,000
Drainage 2/	675,000
IDC 3/	281,000
Economic Cost of Energy 4/	206,000
O&M 5/	146,000
TOTAL Costs	$4,500,000
Benefits	
Irrigation 6/	$4,949,000
Fish and Wildlife 7/	119,000
BLM 8/	70,000
Unemployment 10/	112,000
Municipal and Industrial 11/	37,000
TOTAL Benefits	$5,287,000
Net Benefits	$ 787,000
Benefit-Cost Ratio	1.17

1/ Canal and pumping plant ($37,000,000 x .08627) $3,192,000

2/ Drainage ($28,000,000 divided by 40 years x 11.17051 x .08627 $ 675,000

3/ IDC ($37,000,000 x .088 x .08627) $ 281,000

4/ Cost of Energy $\frac{34,800 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0197}{.75 \text{ efficiency}}$ $ 206,000

5/ O&M

Canal and Pumping Plant	$ 120,000
Energy (34,800 acre-feet x 314 kwh x .0025)	26,000
$\frac{34,800 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0025}{.75 \text{ efficiency}}$	$ 146,000

6/ Irrigation

Junior Water Rights (25,000 acres x $142/acre)	$3,550,000
Fort Belknap (9,850 acres x $142/acre)	1,399,000
	$4,949,000

7/ Fish and Wildlife

O&M (12,700 acre-feet x $3.45/acre-foot)	$ 44,000
Energy $\frac{12,700 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0197}{.75 \text{ efficiency}}$	75,000
	$ 119,000

8/ BLM

O&M (7,500 acre-feet x $3.45/acre-foot)	$ 26,000
Energy $\frac{7,500 \text{ AF} \times 220' \text{ TDH} \times 1.025 \times \$.0197}{.75 \text{ efficiency}}$	44,000
	$ 70,000

10/ Unemployment ($37,000,000 x $3,023/$1,000,000) $ 112,000

Table 4.11

PAYMENT CAPACITY AND REIMBURSABLE COSTS
VIRGELLE-MILK 175-ft^3/s CANAL ALTERNATIVE

	Payment Capacity ($/Acre)	OM&R ($/Acre)	Available For Repayment (/Acre) (Total/Year)	Reimbursable Costs Paid By Water User	Water Charges
Landowners with Junior Water Rights	19.63	1.23 1/	18.40	$7,770,000 2/	$19.63
Fort Belknap Reservation	19.63	1.67 3/	Deferred	$4,147,000 4/	Deferred

1/ OM&R - 7,300/34,300 x $147,000 divided by 25,000 acres = $1.23/acre
2/ Canal - 7,300/34,300 x $37,000,000 divided by
25,000 acres divided by 40 years = $7.77/acre
Drainage - $23,000,000 x .00327 (40 years,
8-5/8 percent sinking fund) = $3.66/acre
OM&R = $1.28/acre
3/ OM&R - 3,900/34,800 x $147,000 divided by 9,850 acres = $1.67/acre
4/ Canal - 3,900/34,800 x $37,000,000

Alternatives and Canal Routes Dropped from Consideration

Five alternative canal systems were originally considered for Phase 3 - the Virgelle-Milk River, Marias-Milk River, Telegraph Creek-Beaver Creek, and the Duck Creek-Vandalia, and Tributary Dam Alternatives. These alternative canal systems are shown on Figure 4.5. The canals were originally sized at 310 ft^3/s. As can be seen from Table 4.11, the only economically feasible alternative was the Virgelle-Milk Canal Alternative, so no further study was done on the other alternatives. These alternatives are described in more detail below.

For the Virgelle-Milk River Canal Alternative, four canal routes were considered: the Railroad, East Side, West Side, and Big Sandy Creek Routes. The costs for all four routes were comparable. The Big Sandy Creek Route and the Railroad Route, which would disrupt the fewest local farm operations, were further developed during plan formulation.

The Big Sandy Creek Route was preferred by local people, but the environmental effects were unacceptable to other parts of the public and to the Montana Department of Fish, Wildlife and Parks. The selected route - the Railroad Route - seemed to be the most acceptable to all groups based on the comments received. The three routes dropped are described here, after the alternatives considered but dropped.

Marias-Milk Alternative

This was the primary plan proposed in the 1970 Feasibility Report by the Bureau (Bureau of Reclamation, 1970). It included an 82-mile-long canal connecting Lake Elwell on the Marias River with Fresno Reservoir on the Milk. Water would be diverted from Lake Elwell by a tunnel in the north abutment of Tiber Dam. The canal would follow the Marias River bluffs below their crest for about 10 miles before crossing cropland, and enter Fresno Reservoir.

Water could be delivered along the canal route to Lonesome Lake and Chain-of-Lakes to benefit fish and wildlife. A fish screen would prevent the transfer from the Marias River of undesirable fish and their eggs, and parasites. Nearly 12,000 additional acres could be irrigated along this canal route, but were not included in the original cost estimate.

Table 4.12

COMPARISON OF ALTERNATIVE CANAL SYSTEMS
DROPPED FROM CONSIDERATION

	Virgelle-Milk Canal	Marias-Milk Canal	Telegraph Creek-Beaver Creek	Duck Creek Vandalia	Tributary Dams
Average Annual Water Diverted (Acre-Feet)	92,000	108,000	144,000	63,000	70,900 1/
Average Annual Water Delivery (Acre-Feet)	77,800	77,800	77,800	56,000	23,900 2/
Acres Receiving Replacement Water 3/	149,660	149,660	149,660	107,730	46,000
Construction Cost 4/	$41,700,000	$69,200,000	$77,390,000	$55,782,000	$107,800,000
Annual Operation and Maintenance	872,000	407,000	1,125,000	114,000	365,000
Total Annual Equivalent Cost 5/	5,103,000	7,627,000	8,977,000	5,773,000	11,629,000
Annual Direct Benefits	$ 5,837,000	$ 5,837,000	$ 5,837,000	$ 4,201,000	$ 1,794,000
Benefit/Cost Ratio	1.14	.77	.65	.73	.15
Economic Cost/Acre-Foot Water Delivered 6/	66	98	115	103	487

1/ Active storage capacity of the reservoirs.
2/ Firm annual yield of the four reservoirs.
3/ Does not include canalside irrigation.
4/ The cost estimates are based on October 1984 price levels. Estimates include 10 percent unlisted items, 25 percent contingencies, and 30 percent indirect costs, except on pumping plants which have 40 percent indirects.
5/ Includes construction and interest during construction annualized at 8-5/8 percent for 100 years, annual energy cost of power, and OM&R costs.
6/ Total annual equivalent cost divided by average annual water delivery.

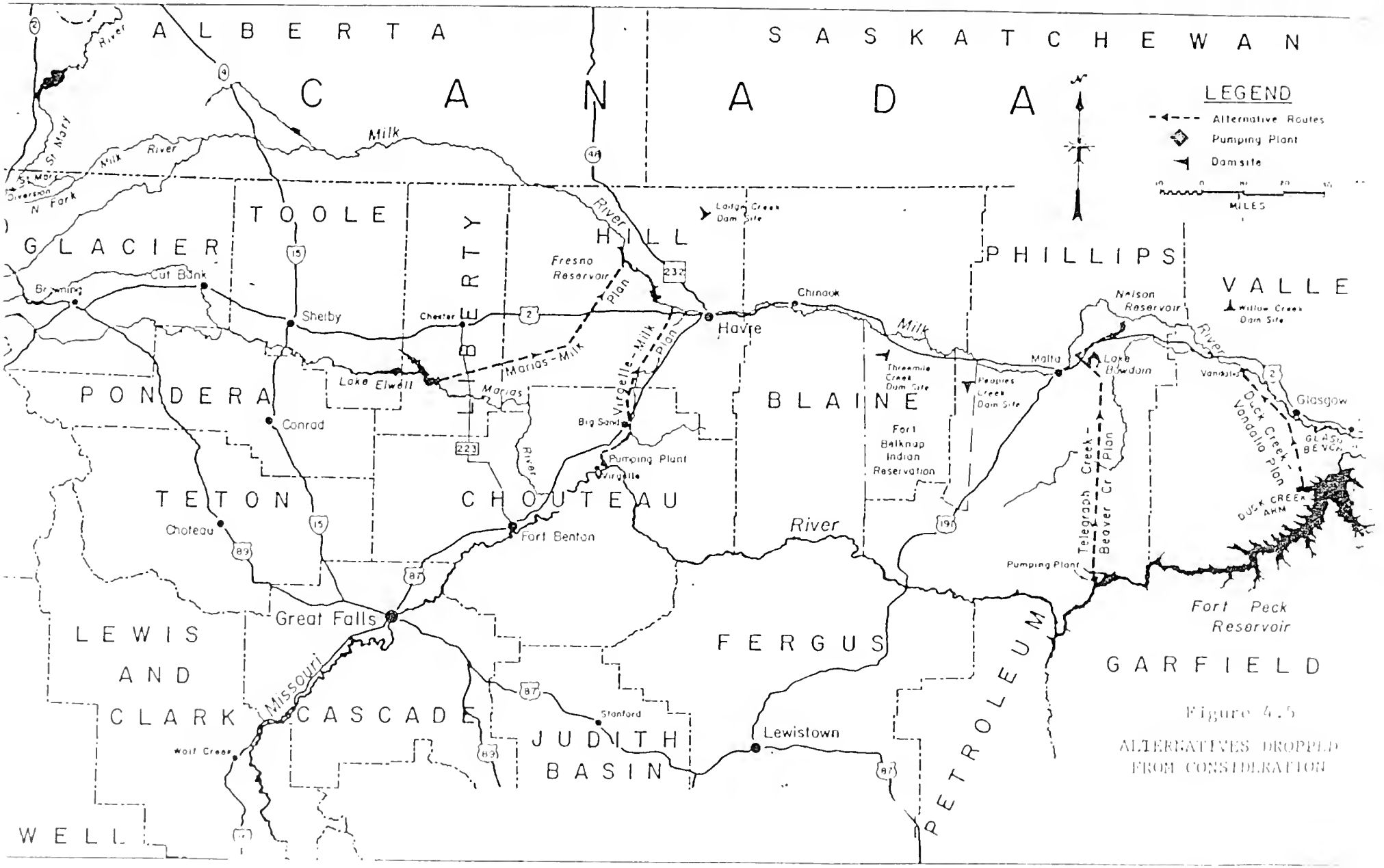


Figure 4.5

ALTERNATIVES DROPPED FROM CONSIDERATION

The canal could be routed away from the bluffs by a longer and more expensive tunnel, or it could be routed to join the Milk River below Fresno Reservoir. This latter route would eliminate the need for the fish screen, but it would increase the canal cost, making the overall cost about the same.

Telegraph Creek-Beaver Creek Alternative

This alternative would pump Missouri River water from Fort Peck Reservoir near Skibby Bottom south of Fourchette Bay near the mouth of Telegraph Creek. The water would be lifted into a 75-mile canal, which would carry the water to Nelson Reservoir, across the Telegraph Creek-Beaver Creek divide.

A 280-ft^3/s capacity pumping plant would be required, with a total dynamic head of 240 feet. Electric power for the pumping plant would come from the 161-kilovolt transmission line between Malta and Havre, requiring a substation at the line, 55 miles of new 69-kilovolt line, and a substation at the pumping plant. Peak power demand would be 7,600 kilowatts, an average annual demand of about 32,500,000 kWh.

The canal would parallel Telegraph and Beaver Creeks before entering the South Feeder Canal in Nelson Reservoir. It would be lined with compacted earth for 60 miles and unlined for the other 15 miles.

The original capacity of 280 ft^3/s would reduce to a terminal capacity of 210 ft^3/s. Major structures along the canal include 11 short siphons and 2 siphons (each 1-mile long), 1 drop structure, numerous cross drainage structures, and an inlet structure at the Nelson South Feeder Canal.

Fourteen miles of the Nelson South Feeder Canal would be enlarged from its present capacity of 500 ft^3/s to 710 ft^3/s. The canal and other major structures would be equipped with protective and escape devices as necessary.

Duck Creek-Vandalia Alternative

This alternative would divert water by gravity to the Milk River Basin from Fort Peck Reservoir. By excavating a channel from the South Fork Duck Creek

Arm of Fort Peck Reservoir to the Willow Creek drainage, water from Fort Peck Reservoir would be conveyed by 31 miles of canal through the Vandalia area to the Milk River. Enroute to the river, some water would be diverted to the Vandalia Canal for 18,000 acres of irrigated lands in the area. Water now being passed upstream might then be used to supplement irrigated lands above Vandalia.

To divert water by gravity from Fort Peck Reservoir, a cut of approximately 100 feet through the South Fork Duck Creek Arm would be required. The conveyance canal would have an initial capacity of 260 ft^3/s and a terminal capacity of 90 ft^3/s. Major structures on the canal would consist of two siphons, two drops, and laterals to the Vandalia Canal. There would also be several drainage inlets and cross drainage structures. The canal and all major structures would be equipped with appropriate protection and escape devices.

If the Fort Peck Reservoir water level were ever drawn down below the canal level, a pumping plant would be required (included in the cost estimate). The Duck Creek-Vandalia Canal inlet water surface would be at elevation 2200 feet, and the maximum drawdown of Fort Peck Reservoir would be to a water surface elevation of 2160 feet, according to the U.S. Army Corps of Engineers.

The peak electric power demand for the Duck Creek pumping plant would be about 1,750 kilowatts with a maximum estimated annual energy requirement of about 560,000 kWh. Power would be available from Federal facilities in the Fort Peck area.

Tributary Storage Alternative

Four offstream storage sites were considered on Lodge Creek, Three Mile Cre , Peoples Creek, and Willow Creek, all tributaries of the Milk River. Water would be stored behind these dams in the off season to be released during irrigation season.

The four dams, with a combined storage capacity of 70,900 acre-feet, would provide an additional 23,910 acre-feet of water in critical years during the irrigation season, which would benefit about 46,000 acres. In most years more water could be provided.

Lodge Creek Dam site would be located about 25 miles north of Havre. A zoned earthfill dam 60 feet high and 1,800 feet long would be built with a grass-lined chute spillway with a concrete crest. The 2,700-acre reservoir formed by the dam could store 10,900 acre-feet of water for irrigation.

Willow Creek damsite is located in Valley County north of Hinsdale. It would be a zoned earthfill dam 82 feet high and 2,760 feet long. It would have a concrete chute spillway. The reservoir would cover 580 acres and hold 11,000 acre-feet for irrigation use.

Reclamation and DNRC reviewed 17 sites recommended by the Fort Belknap Tribal Council for dams. Two of these sites were worthy of detailed investigation - Three Mile and Peoples Creek. Three Mile Dam site would be on the reservation, 3 miles south of Fort Belknap agency. The dam would be zoned earthfill 85 feet high and 2,130 feet long. Three Mile Dam would have a concrete-lined chute spillway. The reservoir would cover nearly 1,000 acres, holding 19,000 acre-feet of water. Since the creek would not supply enough water to fill the reservoir, a 150-ft^3/s pumping plant would be necessary to add Milk River flood flows for as long as 2 months in the spring. Water would then be released when needed for irrigation.

Peoples Creek damsite is located on Fort Belknap Reservation southwest of Dodson. It would be a zoned earthfill dam 120 feet high and 1,200 feet long. It would have a concrete lined side chute service spillway and a grass lined auxiliary spillway. The reservoir would cover about 860 acres and hold nearly 30,000 acre-feet of water.

Other Virgelle-Milk Canal Routes

Figure 4.6 shows the three canal routes for the Virgelle-Milk Canal Alternative, which were considered but dropped for reasons discussed below.

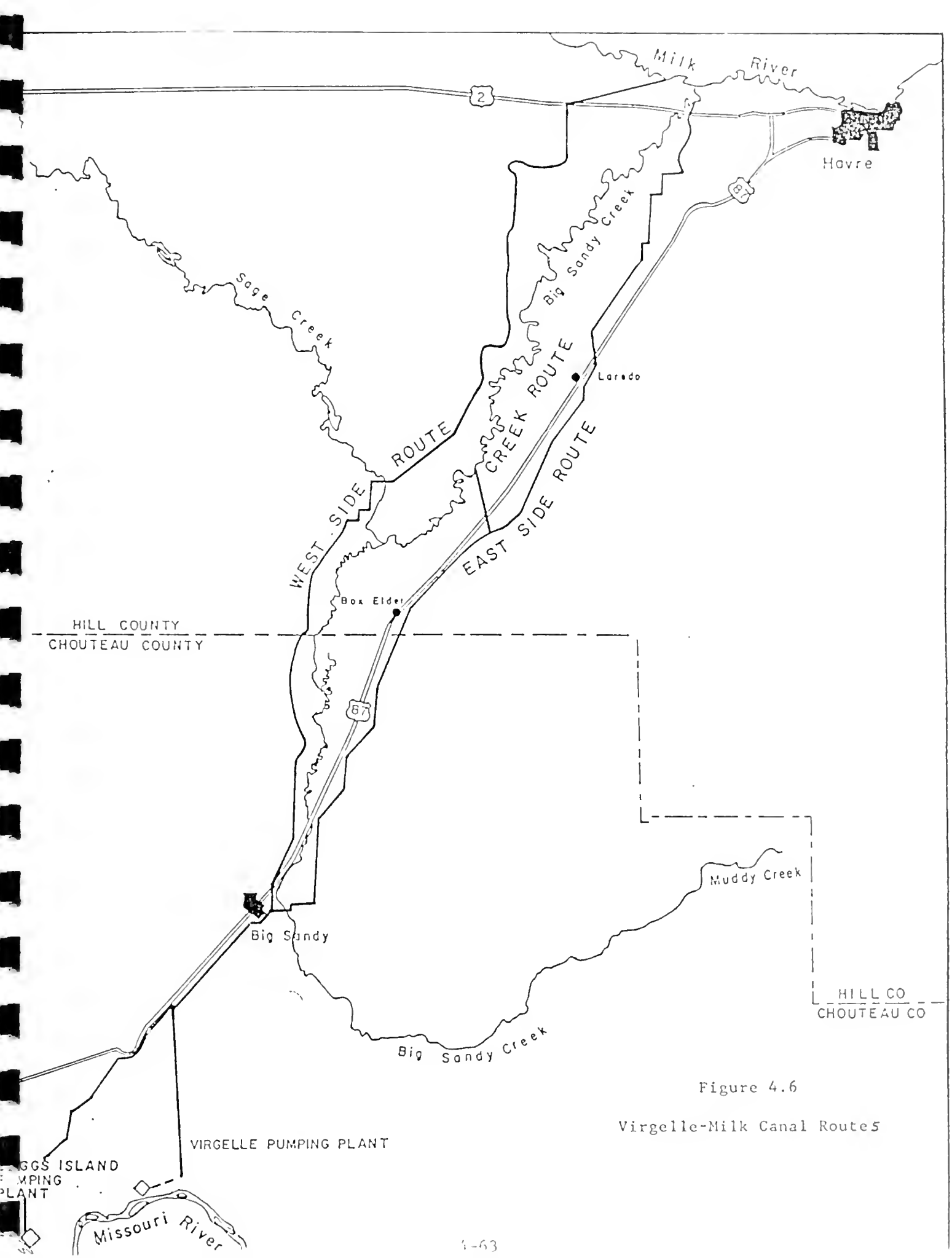


Figure 4.6

Virgelle-Milk Canal Routes

The East Side Canal Route would be located on the east side of Big Sandy Creek. This route would parallel U.S. Highway 87 to the vicinity of Laredo. Here the canal would cross the highway, heading north and northeastward until it joined the Milk River west of Havre. Costs were included to line the entire 46.6 miles of this canal with compacted earth.

The East Side Canal Route needs 10 siphons, 8 concrete drop structures, 27 bridges, and a terminal drop structure, electric transmission facilities. Estimated canal cost would be $26,000,000 (excluding structures).

The East Side Canal Route would cross 56 farms, which is more than any of the other four canal routes. This route would cause the loss of 200 acres of grassland habitat. Cultural resources in the area would also be affected.

The Big Sandy Creek Route would be identical to the East Side Route to a point midway between the towns of Box Elder and Laredo, where it would jog to the west to join Big Sandy Creek. From that point to the Milk River, the creek would act as the conveyance facility. Total length would be 64.5 miles, 32 of which would be in the creek. The other 32.5 miles would require lining.

Seven siphons and six drop structures would be required for this route. No terminal drop structure would be needed, but a stilling basin near the mouth of the creek was planned. The Big Sandy Creek Route would require 20 bridges across the canal. Electrical transmission requirements would be as described for the Railroad Route.

The Big Sandy Creek Route would require work in the creek itself; earthwork along curves, 14 rock drop structures to reduce velocities to less than 2 ft/s and about 12,000 jacks 12-feet long to reduce erosion. The canal would cost $20,150,000 (structures not included), the cheapest of the four routes.

This canal route would cross 50 farms, and have the greatest effects on fisheries, water quality, aesthetics and cultural resources of the four routes.

The West Side Canal Route would be located west of Big Sandy Creek. North of the town of Big Sandy, this route would cross Highway 87, paralleling the creek to the vicinity of Laredo. After this point, the route would head northward to join the Milk River west of Havre.

The other three canal routes were laid out to pass through the ancient Missouri River channel with its gravel lenses and coarse soils, so they would require a full lining to reduce seepage. Only half of the 51.3 miles of the West Side Route would pass through these soils, and would require lining. The other half would be built in glacial till soils west of Big Sandy Creek.

The West Side Canal Route would need 6 siphons, 5 drop sructures, and 30 bridges. Electrical transmission facilities and the terminal drop structure would be as described for the Railroad Canal Route. The canal cost for this route would be $24,300,000.

This route would cross 51 farms and cause the loss of 100 acres of grassland habitat, and could affect cultural resources.

CHAPTER 5: PLAN SELECTION

The solution to the Milk River water shortage involves basin-wide management of the water supply available; rehabilitation of the aging canals, laterals, and onfarm systems; and a new source of water. The proposed three-phased plan is structured to provide this solution.

As discussed in Chapter 4, Phase 1 is continuing, and Phase 2 would be implemented under the Rehabilitation and Betterment Program to rehabilitate the entire system. Phase 3 would provide a new water supply to the basin. The irrigators and State are seeking congressional authorization to financially integrate Phases 2 and 3 as part of the Pick-Sloan Missouri Basin Program.

A comparison of the three viable canal alternatives evaluated for Phase 3 is presented in this chapter: Virgelle-Milk 175-ft^3/s Canal Alternative, Virgelle-Milk 200-ft^3/s Canal Alternative, and Virgelle-Milk 230-ft^3/s Canal Alternative. The Virgelle-Milk 230-ft^3/s Canal Alternative was selected as the Preferred Plan.

COMPARISON ANALYSIS OF VIABLE ALTERNATIVES

Virgelle-Milk 175-ft^3/s Canal Alternative (NED Plan)

The National Economic Development (NED) Plan for this report, as required by Reclamation criteria, is the Virgelle-Milk 175-ft^3/s Canal Alternative. The NED Plan maximizes benefits for the investment. Landowners with junior water rights and the Fort Belknap Reservation would be provided a full water supply as defined by Reclamation shortage criteria. This criteria stipulates that shortages cannot exceed 50 percent in any 1 year or 100 percent any 10 consecutive years. A water supply would also be provided to Bowdoin National Wildlife Refuge, city of Chinook, and for exchange of tributary water for BLM stockponds. The net benefits are $787,000. There are no significant environment impacts as a result of this plan. The additional water supply will improve the waterfowl habitat at Bowdoin National Wildlife

Refuge. Major social effects include those resulting from the canal; the annual costs and income attributable to the plan; and the extent to which Indian lands are irrigated. Existing dryland farm operations of landowners along the canal would be disrupted (see Social Account Comparison). The plan has been formulated to limit this disruption by building the canal along the existing railroad right-of-way and providing adequate canal crossings. These farmers are also concerned about spread of weeds and increase of saline seeps. The infiltration gallery design for the pumping plant would reduce spread of weed seeds. A weed control board is recommended to ensure weed control on the canal right-of-way. Membrane lining in the canal would ensure saline seeps would not increase.

Average annual increased agricultural income (both direct and indirect) resulting from the project would be about $6.9 million. The project would include the irrigation of 9,850 dryland equivalent acres on the Fort Belknap Reservation, and about $2.2 million of this increase would accrue to tribal irrigators. Annual construction and OM&R costs would be imposed on the irrigators. Annual equivalent economic costs would be about $6.4 million, with about $1.5 million of this amount accruing to the reservation. However, reservation costs would be deferred under the Leavitt Act.

Virgelle-Milk 200-ft^3/s Canal Alternative

The Virgelle-Milk 200-ft^3/s Canal Alternative would serve the landowners with junior water rights, the Fort Belknap Reservation, and the Rocky Boys Reservation. Water would also be provided to Bowdoin National Wildlife Refuge, BLM stockponds, and city of Chinook.

Social effects of the Virgelle-Milk 200-ft^3/s Canal Alternative would be similar to those discussed under the NED Plan, except that annual equivalent construction costs would be about 25 percent greater, and annual income would be about 10 percent higher. Corollary socio-economic effects would thus be

proportionally greater. This plan includes the irrigation of 3,300 acres on the Rocky Boys Reservation.

NED perspective serving Rocky Boy's Reservation is not incrementally feasible. Providing water to the reservation, however, is justified due to improved social well-being on the reservation and from a "Regional Development" (RD) standpoint.

Virgelle-Milk 230-ft^3/s Canal Alternative (Preferred Plan)

The Preferred Plan would provide a water supply to all water users who still experience severe water shortages after the implementation of Phase 2. This includes the water users served by the 175 ft^3/s Canal Alternative, the Rocky Boys Reservation, and private canalside irrigators.

Several private landowners along the canal route have indicated an interest in irrigation. It is not incrementally feasible from a NED standpoint to provide these irrigators with a water supply, distribution system, and drainage system. Therefore, they are included in the Preferred Plan on the condition that the costs be funded by a non-Federal entity (see "Cost Sharing" in this chapter). From a regional benefit standpoint, provision of irrigation services to these lands is feasible. The added direct income, as well as indirect benefits to economy of the area from irrigation services, indirect construction benefits, and benefits from OM&R expenditures, exceed the costs accruing to the region for providing irrigation (see the "RD Account" to follow).

The Preferred Plan is economically justified and would have a positive effect on the environment.

Social effects of the Preferred Plan would be similar to those of the NED Plan, except that annual equivalent construction costs would be about 42 percent greater, and annual income would be about 19 percent higher. Thus, corollary socio-economic effects would be proportionally greater.

Four Account Analysis

Reclamation compares the economic, environmental and social effects of alternatives by means of the "four accounts." The four accounts are defined below and detailed in Tables 5.1 through 5.3.

National Economic Development (NED) Account: An economic analysis that displays the beneficial and adverse effects on the national economy. Benefits include increases in the economic value of the national output of goods and services and the value associated with the use of unemployed or under employed labor resources.

Regional Development (RD) Account: An economic analysis that displays the transfer of wealth between the planning region and the rest of the Nation. The region used for this analysis is the Bureau of Economic Analysis Economic Area 94, which is essentially the northern half of Montana east of the Rocky Mountains. These regional benefits include NED benefits plus income transferred to the region, including increases from irrigation services, construction impacts, and OM&R impacts. Regional benefits accruing to the Fort Belknap and Rocky Boys Reservations are identified separately.

Fort Belknap and Rocky Boy's Regional Subaccount

The project impacts the Fort Belknap and Rocky Boy's Reservations; therefore, a regional subaccount was developed for each of the three viable alternatives (see Table 5.1). The direct irrigation benefits for the subaccounts were based on the percentage of Indian ownership of project lands. Employment benefits were derived assuming 50 percent of the unskilled and 30 percent of the skilled onsite construction labor would be Indian. The incidence of indirect regional benefit segments on the reservations was determined as follows. Increases from irrigation services were apportioned based on the proportion of irrigation direct benefits accruing on the reservation, reduced by 50 percent according to Reclamation guidelines to reflect reduced commercial or multiplier capacity on the reservation. Construction effects were based on the proportion of Indian employment, again reduced by

Table 5.1
COMPARISON OF NATIONAL ECONOMIC DEVELOPMENT (NED)
AND REGIONAL DEVELOPMENT (RD) ACCOUNTS ($1,000)

	Virgelle-Milk 230-ft^3/s Canal Alternative (Preferred Plan)					Virgelle-Milk 200 ft^3/s Canal Alternative					Virgelle-Milk 175 ft^3/s Canal Alternative (NED Plan)				
		RD Account					RD Account					RD Account			
		Planning Region					Planning Region					Planning Region			
	NED Account	Total	Reservation Portion	Rest of Nation	Total	NED Account	Total	Reservation Portion	Rest of Nation	Total	NED Account	Total	Reservation Portion	Rest of Nation	Total
Annual Beneficial Effects:															
Irrigation	$ 6,084	$ 6,084	$ 1,947 1/	$ —	$ 6,084	$ 5,607	$ 5,607	$ 1,906 1/	—	$ 5,607	$ 5,122	$ 5,122	$ 1,434 1/	$ —	$ 5,122
Fish and Wildlife	140	140	—	—	140	140	140	—	—	140	140	140	—	—	140
BLM	71	71	—	—	71	71	71	—	—	71	71	71	—	—	71
Drainage	675	675	—	—	675	675	675	—	—	675	675	675	—	—	675
Unemployed Resources	156	156	156	—	156	138	138	138	—	138	112	112	112	—	112
Regional Benefits	—	4,398 2/	781 3/	-4,398	—	—	3,976 13/	730 14/	-3,976	—	—	3,570 8/	591 9/	-3,570	—
Total Annual Benefits	$ 7,126	$11,524	$ 2,844	$-4,398	$ 7,126	$ 6,631	$10,607	$ 2,774	$-3,976	$ 6,631	$ 6,120	$ 9,690	$ 2,113	$-3,570	$ 6,120
Annual Adverse Effects:															
Project Costs															
Construction	$ 4,443	$ 2,488	$ —	$ 1,955 4/	$ 4,443	$ 3,951	$ 2,004	$ —	$ 1,947 4/	$ 3,951	$ 3,192	$ 2,045	$ —	$ 1,147 10/	$ 3,192
Drainage	844	765	—	79 5/	844	675	675	—	—	675	675	675	—	—	675
IDC	391	—	—	391	391	348	—	—	348	348	281	—	—	281	281
Opportunity Costs of Power	356	356	94 6/	—	356	283	283	94 6/	—	283	215	215	3 11/	—	215
OM&R	313	313	109 7/	—	313	232	232	109 7/	—	232	147	147	13 12/	—	147
Total Adverse Effects	$ 6,347	$ 3,922	$ 203	$ 2,425	$ 6,347	$ 5,489	$ 3,194	$ 203	$ 2,295	$ 5,489	$ 4,510	$ 3,082	$ 16	$ 1,428	$ 4,510
Net Beneficial Effects:	$ 779	$ 7,602	$ 2,681	$-6,823	$ 779	$ 1,142	$ 7,413	$ 2,571	$-6,271	$ 1,142	$ 1,610	$ 6,608	$ 2,097	$-4,998	$ 1,610

1/ Computation based on ratio of reservation irrigated acreage to total irrigated acreage.
2/ Includes increases from irrigation services of $2,426 (000), construction effects of $1,878 (000), and labor portion (30 percent) of OM&R costs $94 (000).
3/ Includes increases from irrigation services of $385 (000), construction effects of $366 (000), and reservation portion of OM&R labor costs $30 (000).
4/ Percent of costs allocated to reservations, based on Fort Belknap and Rocky Boy's incremental capital costs of $22,600 (000).
5/ Rocky Boy's drainage costs.
6/ Based on the reservation proportion of power requirements.
7/ Reservation OM&R costs.
8/ Includes increases from irrigation services of $2,042 (000), construction effects of $1,484 (000), and labor portion (30 percent) of OM&R costs $44 (000).
9/ Includes increases from irrigation services of $289 (000), construction effects of $289 (000), and reservation portion of OM&R labor costs ($13,000).
10/ Percent of costs allocated to Fort Belknap Reservation, based on Fort Belknap incremental capital costs of $13,300 (000).
11/ Based on Fort Belknap Reservation power requirements.
12/ Fort Belknap OM&R costs.
13/ Includes increases from irrigation services of $2,236 (000), construction effects of $1,670 (000), and labor portion (30 percent) of OM&R costs $70 (000).
14/ Includes increases from irrigation services of $380 (000), construction effects of $326 (000), and reservation portion of OM&R labor costs $24 (000).

50 percent to reflect reduced multiplier capacity on the reservation. Operation, maintenance, and replacement effects were apportioned based on the Indian percent of OM&R labor costs.

Social Account: This account displays the impacts on the social environment, including factors like population distribution, employment opportunities, distribution of income and other social concerns.

Multi-Attribute Tradeoff System (MATS): The MATS program was used to evaluate the net effects of five impact factors which are considered to be "social resources." These factors and the weightings selected were based on an appraisal of concerns voiced by project area farmers in a series of meetings and informal questionnaires. The results of the evaluation, including gross and net social well-being (SWB) scores, are displayed in Table 5.2.

EQ Account: This analyzes the overall affect a proposed plan would have on the environment, including significant ecological, aesthetic and cultural resource effects that cannot be measured in monetary terms (see Table 5.3).

Four Tests of Viability

An alternative proposed by Reclamation must also meet "four tests" to confirm its viability. The Preferred Plan meets these four tests:

1. Completeness is the extent to which an alternative provides for all necessary investments to ensure realization of the planned effects. All costs are included to sustain irrigation on the benefiting lands for a 100-year project life and mitigation costs for unavoidable environmental impacts.

2. Effectiveness is the extent to which an alternative meets the specified problems and achievements. The Virgelle-Milk Canal would provide water to meet all the needs identified during the study as detailed in Chapter 4.

3. Efficiency examines the cost effectiveness of the various plans. The benefit to the water users of the Virgelle-Milk Canal Alternative would exceed the costs.

Table 5.2

COMPARISON OF SOCIAL ACCOUNTS

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal 230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Farms Crossed (By Canal)	The Big Sandy area is presently dryland farmed.	No change in Big Sandy area.	19 farms crossed by canal - 35 bridges provided, averaging about 1-mile intervals.	Same as Preferred Plan.	Same as Preferred Plan.
Weed Spread	Spotted knapweed and leafy spurge not known to occur along canal route.	No change in Big Sandy area.	Potential for weed spread, controlled by infiltration design pump, and weed control programs.	Essentially same as Preferred Plan.	Essentially same as Preferred Plan.
Seepage from Canal	Saline seeps occur in Big Sandy area.	No change in Big Sandy area.	Seepage from canal controlled by canal lining and toe drains.	Essentially same as Preferred Plan.	Essentially same as Preferred Plan.
Population	Rural area. Historical trend of rural population decline.	Overall population increase of about 10 percent by year 2000. Historical trend of rural population decline will continue. 1/ Increase of 100 people during 10-year construction period.	Construction period population increase of 290 people, mostly in Hill and Choteau Counties.	Same as Preferred Plan, except increase of 260 people during construction.	Same as Preferred Plan, except increase of 230 people during construction.
		Slight decrease in rate of long-term rural population loss.	Slight decrease in rate of long-term rural population loss.		
Employment	Historical trends of increases in urban and decline in rural areas.	Continuation of historical trends.	Direct onsite employment during construction of 180 jobs, 70 available to Rocky Boy's and Fort Belknap Reservations. Increase of 45 agricultural jobs.	Onsite employment of 160 jobs, 60 available to reservations. Increase of 40 agricultural jobs.	Onsite employment of 140 jobs, 50 available to reservations. Increase of 40 agricultural jobs.
	High unemployment on Rocky Boy's and Fort Belknap Reservations.	Unemployment on reservations will remain high.			
		Annual direct onsite employment of 50 jobs during 10-year construction period.			

1/ Source: 1980 OBERS Regional Projections, U.S. Department of Commerce.

Table 5.2

COMPARISON OF SOCIAL ACCOUNTS
(Continued)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal		
			230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Income (During Construction and Annual Agricultural Income)	Area is dependent upon agricultural base which is stabilized by irrigation. Per capita income below national average. Annual average water shortages of over 20 percent will continue to have an adverse impact on income.	Per capita income will remain below national average. Current dollar income will increase by 60 percent by year 2000, but ag sector by only 35 percent. 1/ Earnings during construction would be about $2.7 million. Indirect regional earnings of about $2 million. Average increased annual direct and indirect agricultural income of $8.5 million.	Direct earnings during construction would be about $6.8 million, about $2.7 million of which would accrue to Tribes. Average annual increased direct and indirect agricultural income of $8.2 million, $2.2 million of which would accrue to Tribes.	Similar to Preferred Plan, except construction earnings of $5.9 million, with about $2.3 million accruing to Tribe. Average annual increased direct and indirect agricultural income of $7.6 million; with about $2.2 million accruing to Tribes.	Similar to Preferred Plan, except construction earnings of $4.8 million, with about $1.9 million accruing to the Tribe. Average annual increased direct and indirect agricultural income of $6.9 million, with about $2.2 million accruing to Tribes.
Housing	As of 1980, housing vacancy rate of 15 percent within five counties comprising Milk River Water Supply Study service lands and canal area. Current and future rates should be comparable due to depressed rural economics.	About 20 additional housing units required during construction. Could be accommodated in project area without undue stress.	About 60 additional housing units required during construction.	Same as Preferred Plan, except 55 units required.	Same as Preferred Plan, except 50 units required.
Facilities and Services	Area typical of rural areas in the State, in which provision of social and medical services difficult due to distances traveled.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 30 additional students.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 100 additional students.	Similar to Preferred Plan, except 90 additional students would be accommodated.	Similar to Preferred Plan, except 80 additional students wold be accommodated.

Table 5.2

COMPARISON OF SOCIAL ACCOUNTS
(Continued)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal 230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Annual Cost (Annual Equivalent Economic Cost)	N/A	Annual costs of $8.7 million.	Annual costs of $6.4 million.	Annual costs of $5.5 million.	Annual costs of $4.5 million.
Indian Lands (Acres irrigated)	N/A	N/A	13,150 acres of land irrigated on Fort Belknap and Rocky Boy's Reservations.	Same as Preferred Plan.	9,750 acres of land irrigated on Fort Belknap Reservation.

Table 5.2

COMPARISON OF SOCIAL ACCOUNTS
(Continued)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal		
			230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Income (During Construction and Annual Agricultural Income)	Area is dependent upon agricultural base which is stabilized by irrigation. Per capita income below national average. Annual average water shortages of over 20 percent will continue to have an adverse impact on income.	Per capita income will remain below national average. Current dollar income will increase by 60 percent by year 2000, but ag sector by only 35 percent. 1/ Earnings during construction would be about $2.7 million. Indirect regional earnings of about $2 million. Average increased annual direct and indirect agricultural income of $8.5 million.	Direct earnings during construction would be about $6.8 million, about $2.7 million of which would accrue to Tribes. Average annual increased direct and indirect agricultural income of $8.2 million, $2.2 million of which would accrue to Tribes.	Similar to Preferred Plan, except construction earnings of $5.9 million, with about $2.3 million accruing to Tribe. Average annual increased direct and indirect agricultural income of $7.6 million; with about $2.2 million accruing to Tribes.	Similar to Preferred Plan, except construction earnings of $4.8 million, with about $1.9 million accruing to the Tribe. Average annual increased direct and indirect agricultural income of $6.9 million, with about $2.2 million accruing to Tribes.
Housing	As of 1980, housing vacancy rate of 15 percent within five counties comprising Milk River Water Supply Study service lands and canal area. Current and future rates should be comparable due to depressed rural economics.	About 20 additional housing units required during construction. Could be accommodated in project area without undue stress.	About 60 additional housing units required during construction.	Same as Preferred Plan, except 55 units required.	Same as Preferred Plan, except 50 units required.
Facilities and Services	Area typical of rural areas in the State, in which provision of social and medical services difficult due to distances traveled.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 30 additional students.	Increased pressure on medical and dental facilities during construction. Sufficient school facilities to accommodate 100 additional students.	Similar to Preferred Plan, except 90 additional students would be accommodated.	Similar to Preferred Plan, except 80 additional students would be accommodated.

Table 5.2

COMPARISON OF SOCIAL ACCOUNTS
(Continued)

Factor	Present	Phase 2 - Rehabilitation (Future Without or No Action)	Phase 3 - Virgelle-Milk River Canal		
			230-ft^3/s Canal (Preferred Plan)	200-ft^3/s Canal	175-ft^3/s Canal (NED Plan)
Annual Cost (Annual Equivalent Economic Cost)	N/A	Annual costs of $8.7 million.	Annual costs of $6.4 million.	Annual costs of $5.5 million.	Annual costs of $4.5 million.
Indian Lands (Acres irrigated)	N/A	N/A	13,150 acres of land irrigated on Fort Belknap and Rocky Boy's Reservations.	Same as Preferred Plan.	9,750 acres of land irrigated on Fort Belknap Reservation.

4. Acceptability is whether or not the plan meets acceptance by the local, state and national public. The Milk River Project irrigation districts (through their Board of Directors) and their consultant have been involved in plan formulation. The information presented in this report was summarized at public meetings in January 1988. The irrigation districts circulated a survey following the meeting to help determine if the Phased Plan, including the canal, is acceptable to irrigators as a whole. The results of the survey were very favorable. The State of Montana has shared in the costs of the study and also actively helped formulate the three-phased plan.

National acceptance will be measured during review of the Planning Report/Draft Environmental Statement through the legislative process.

COST SHARING

Department of the Interior policy requires cost sharing on water resource development projects. A non-Federal entity must fund the difference in capital costs between the Preferred Plan and the NED Plan. In this case, the Preferred Plan ($37,000,000) costs $23,000,000 more than the NED Plan. The $10,000,000 cost of private canalside lands would have to be funded by a non-Federal entity. However, it is proposed that the costs for serving Rocky Boys Reservation would be paid by the Federal Government to assure the social well-being of the reservation as follows.

Rocky Boys Reservation	
Additional Canal Capacity	$ 4,500,000
Distribution System	4,800,000
Drainage System	3,400,000
Subtotal	$12,700,000
Private Canalside Acres	
Additional Canal Capacity	$ 2,500,000
Distribution System	3,700,000
Drainage System	3,900,000
Subtotal	$10,100,000
Total	$22,800,000
Rounded	$23,000,000

Table 5.3

ENVIRONMENTAL QUALITY ACCOUNT

Environmental Factor:	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	Phase 3 - Virgello-Milk River Canal Alternative: 230 ft^3/s Canal (Preferred Plan)	Significance 2/	200 ft^3/s Canal	Significance 2/	175 ft^3/s Canal (NED Plan)	Significance 2/
Rivers									
Missouri River	Annual flow is 6,333,000 acre-feet.	Flows would continue as occur presently.	o	Project would withdraw up to 230 ft^3/s during April through September, the effects of which would be unmeasurable most years. Instream flow requirements would be met.	o	Project would withdraw 200 ft^3/s up to during April through September, the effects of which would be unmeasurable most years.	o	Project would withdraw 175 ft^3/s up to during April through September, the effects of which would be unmeasurable most years.	o
Milk River	Average annual flow in Milk River is 267,150 acre-feet.	Inflow to Milk River will decrease 40,000 acre-feet if Canadian projects are developed. Restoration of St. Mary's Canal will increase flows an average of 16,000 acre-feet.	-	Supplemental (replacement) water from Missouri River, in conjunction with future w/o conditions will assure full water supply to irrigators and maintain or enhance fish and wildlife resources.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Marias River and Lake Elwell	Lake Elwell is operated primarily for flood control. Consequently, reservoir elevations, and river flows below Tiber Dam, fluctuate considerably.	Present conditions would continue.	o	Releases from Lake Elwell to replace instream flows in the Missouri River would increase reservoir fluctuations but should improve flows in the lower Marias downstream of the dam in dry years.	+ + +	Same as under Preferred Plan.	+ + +	Same as under Preferred Plan.	+ + +
Bowdoin National Wildlife Refuge	Inadequate water supply to maintain adequate water levels and freshen ponds.	Excess water could be available more often for Lake Bowdoin (estimate 2,700 acre-feet annual).	+	Additional water in the Milk River could be used to benefit productivity of Bowdoin National Wildlife Refuge and freshen refuge.	+ + +	Same as under Preferred Plan.	+ + +	Same as under Preferred Plan.	+ + +
Surface Water Quality									
Trace Elements	Iron, nitrate, manganese, selenium concentrations greater than primary and secondary drinking water standards were found on scattered sample sites in glacial till and alluvium.	Same	o	Isolated sites with high concentrations would probably not seriously impair use of irrigation return flows. Irrigation of water-soluble concentrations would be further limited by land classification and by factors like drainage and slope, which would eliminate most till lands from the project. Remaining lands would not cause significant increases in concentrations in return flows.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o

Table 5.3 (Co nued)

Environmental Factor:	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	Phase 3 - Virgelle-Milk River Canal Alternative: 230 ft³/s Canal (Preferred Plan)	Significance 2/	200 ft³/s Canal	Significance 2/	175 ft³/s Canal (NED Plan)	Significance 2/
Pesticides	Analysis of five sites found all pesticide concentrations, except Picloram (Tordon), ranging from 1.0 ug/g of Triallate at the Loredo dryland site, to 30.6 ug/g of Dicarba (Bandvel) at the Loredo irrigated site. All samples taken later (in October) below detection limits, showing pesticides do not persist in soil or drain water within a growing season.	Same	o	Same	o	Same	o	Same	o
Groundwater (Seepage)									
Milk River Basin	Existing irrigation facilities have seepage problems which, in turn, have caused the loss of agricultural productivity on the affected lands.	Rehabilitation of existing facilities and designs eliminating/reducing seepage from new facilities will return productivity to affected lands.	+	No change.	o	Same as under Preferred	o	Same as under Preferred	o
Fisheries									
Milk River	Classified as B-3. Fisheries resources are reduced during dry years because of low runoff, low releases from reservoir, and increased withdrawals for irrigation.	Biological assessment for the individual R&B and C&R projects concluded "no effect." An analysis regarding the cumulative effects concluded no effect.	o	Flows in river will be at higher level during dry years which should enhance fishery.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Missouri River	Same as Milk River.	No change.		Infiltration gallery design will minimize potential for impacting fisheries. Construction of gallery and pumping plant may disturb potential spawning areas during construction period.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o
Marias River	Classification is B-3 below Tiber Dam.	No change.	o	Releases from Tiber Dam would benefit fishery in Lower Marias.	+	Same as under Preferred Plan.	+	Same as under Preferred Plan.	+
Wildlife Habitat	Habitat had developed along the existing canal system and on some adjacent lands due to seepage.	Rehabilitation of existing facilities and construction of new, efficient ones will remove habitat that has developed. However, R&B and C&R projects incorporate mitigation areas to compensate for the losses.	o	Habitat losses that occur as a result of building the canal and irrigating canalside lands will be mitigated for within the canal ROW and by managing an area of Lonesome Lake. Enhancement potential exists at Lonesome Lake.	+	Habitat losses that occur as a result of building the canal will be mitigated for within the canal ROW.	o	Habitat losses that occur as a result of building the canal will be mitigated for within the canal ROW.	P

Table 3 (Continued)

Environmental Factor:	Present Condition	Phase 2 (Future W/O Project) 1/	Significance 2/	Phase 3 - Virgelle-Milk River Canal Alternative: 230 ft³/s Canal (Preferred Plan)	Significance 2/	200 ft³/s Canal	Significance 2/	175 ft³/s Canal (NED Plan)	Significance 2/
Threatened/Endangered Species	Species that could occur in the area are: peregrine falcon, bald eagle, black-footed ferret, and piping plover.	Biological assessments for the individual R&B and C&R projects have concluded no effect. An analysis regarding the cumulative effect of these actions showed no effect.	o	No Effect.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o
Cultural Resources	There are known sites but the specifics are lacking.	Cultural resources survey and mitigation requirements have been accommodated for the individual R&B and C&R projects.	o	Class III survey of canal route and adjacent lands completed.	o	Class III survey of canal route completed.	o	Class III survey of canal route completed.	o
Weeds	Spotted knapweed and leafy spurge presently not known to occur on lands between Milk and Missouri Rivers.	These weeds will eventually invade these lands.	- -	Use of an infiltration gallery for pumping plant intake should prevent transport of seeds from Missouri River. Reclamation recommends a weed control board to assure that canal ROW is properly managed.	o	Same as under Preferred Plan.	o	Same as under Preferred Plan.	o

1/ The Future W/O Project Condition (Phase 2) assumes that the proposed R&B and C&B projects in and along the Milk River will be in place along with improvements in onfarm irrigation efficiency, prior to building the canal. The cumulative effects of this scenario regarding threatened/endangered species, and fish and wildlife resources, is presently being evaluated.

2/
- \- Minor adverse
- \- - Moderate adverse
- \- - - Highly adverse
- o No significant effect
- + + + Highly beneficial
- + + Moderately beneficial
- + Slightly beneficial

FEDERAL REGULATIONS AND EXECUTIVE ORDERS TO BE COMPLIED WITH

To implement the Preferred or NED Plans, compliance with the following would be required: Section 10 of the River and Harbor Act of 1899 (33 USC 403), as amended; Section 404 of the Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended by the Clean Water Act of 1977 (Public Law 95-217); applicable sections of the Wild and Scenic Rivers Act of 1968 (Public Law 90-542); and Executive Order 11988, Floodplain Management.

All necessary permits would be obtained during detailed preconstruction studies.

CHAPTER 6: CONSULTATION AND COORDINATION

Meetings and Issues

One of the primary tools for presenting information to the various publics was a newsletter. Issues were sent to the irrigators in the Milk River Basin; dryland farmers in the Big Sandy area; Indian reservations in the area, and local, State and Federal agencies. Each newsletter dealt with status of the study and issues that had been raised by these groups.

In addition, public meetings were held at intervals during the study to report progress and obtain public input. A summary of the major meetings are listed on Table 6.1.

Reclamation and DNRC representatives frequently attended District Board meetings. Special meetings were held with smaller groups, such as the Chippewa Cree on the Rocky Boys Reservation, the Gros Ventre-Assiniboine on the Fort Belknap Reservation, and the dryland farmers in the Big Sandy area. These are also summarized in Table 6.1.

The Blackfeet Tribe indicated an interest late in the study also (see "Blackfeet Reservation Water Development Potential" in Chapter 1).

The Liberty-Hill Landowners Protection Association represented the landowners along the Marias-Milk Route (see "Alternatives and Canal Routes Dropped from Consideration" in Chapter 4). The Big Sandy Creek Landowners Protection Association was formed to represent the landowners along the Virgelle-Milk Canal Route. The major concerns were disruption of farming operations, transport of weed seeds via the canal and poor weed control on the right-of-way, and the effect of seepage on adjacent fields.

To reduce disruption of local farming, the Creek Route (see Alternatives Dropped) was developed. By using the creek as a conveyance, fewer farms would be severed. The Creek Route was preferred by the local people, but the environmental effects were unacceptable to segments of the public and other

Table 6.1
PUBLIC INVOLVEMENT PLAN
SEQUENCE OF ACTIVITIES

Planning State (Time)	Public Involvement Task	Techniques
November 1983 - Before Official Start	Develop Public Involvement Task	Discuss public involvement approach and rules with UMRC and districts.
December 1983, January 1984 - Before Official Start	Review Public Involvement Plan	Review by MB Planning Division, Public Involvement Officer, and E&R Center
March 1984 - Before Official Start	Explain routing alternatives and obtain public reaction.	Held public meetings in Havre, Malta, and Glasgow. Also met with the Fort Belknap Tribal Council.
February 1984	Discuss feasibility of Rocky Boy Indian Reservation Diversion	Met with Tribal members in Great Falls. Presented costs and obligations. Attempted to get their official position. No official response.
May 1984	Inform other agencies.	Meeting held in Helena to explain study to congressional representatives and State and Federal agencies.
March 1985	Determine public preference for lower end of canal route.	There are four possible variations of the lower end of the canal route. Costs were estimated for the four variations and public preference concerning the variations sought and public meeting in Big Sandy.
Spring 1985	Meet with Milk River Irrigation District.	General meeting about proposed project.
Spring 1985	Consultation on pumping plant site.	Meet with Bureau of Land Management to discuss location of pumping plant site in Wild and Scenic section of Missouri River.
June 1985	Determine public's perception of environmental impacts.	Held a scoping session at Malta, and Big Sandy, Montana. Sent notices of session to news media, Federal Register, and all known area agencies, organizations, and individuals that might be interested.
September 19, 1985	Communicate with public in the canal route area.	Big Sandy Conservation District field day. Explained study to date. Handed out questionnaire concerning canal route.

Table 6.1
(CONTINUED)

Planning State (Time)	Public Involvement Task	Techniques
October 21, 1985	Consultation on pumping plant site and design.	Met with Bureau of Land Management to discuss alternative location of pumping plant and infiltration gallery design.
November 19, 1985	Communicate with Fort Belknap Tribal Council.	Met with Fort Belknap Tribal Council to discuss their participation in the project.
December 3, 1985	Met with Milk River Irrigation District.	Presented results of water supply model which showed some shortages caused by lack of capacity in supply canals.
January 1986 - August 1987	Determine Rocky Boy Indian Reservation participation in study.	Meetings with tribal representatives and their consultant. Meetings were held to establish lands to be classified and to present preliminary land classification results and cost estimates.
February 26, 1986	Discuss concerns of landowners along canal.	Meeting with Big Sandy Conservation District, representatives of Big Sandy Creek Landowners Protection Association, and DNRC.
May 1986	Discuss study results and receive input.	Public meetings.
December 1986	Discuss study status and conservation alternatives.	Meeting with Board of Directors.
January 1987	Discuss conservation alternatives with Chinook Division.	Meeting with Board of Directors.
March 1987	Discuss study results.	Meeting with DNRC representatives and District's consultants.
March 1987	Discuss study results.	Present study results at Irrigation Board of Directors meeting.
May 1987	Present results of study to date and receive input.	Public meetings in Glasgow, Malta and Chinook.

Table 6.1
(CONTINUED)

Planning State (Time)	Public Involvement Task	Techniques
January 1988	Present preliminary results of plan formulation.	
Various	Discuss study activities among study participants.	Meetings among State Irrigation Districts, and Bureau representatives.
Monthly	Keep public informed.	A newsletter was prepared monthly and sent to over 250 individuals and agencies on the mailing list. Each month is a different topic, i.e., weed control, pumping plant site, canal routes, planning process, use of pipe versus findings.

government agencies. A route was designed that would avoid the environmental impacts of the Creek Route and still keep disruption of farm operations to a minimum. This is the Railroad Route, the preferred route. In addition, 35 crossings have been planned along the 46-mile canal to provide farm access.

The second issue, weed control, was addressed at every meeting in the Big Sandy area. Reclamation proposes that a weed control board be formed that would include representatives from Choteau and Hill Counties to assure that weed control along the right-of-way is done adequately by maintenance crews. The infiltration gallery-type design proposed for the pumping plant would eliminate transport of weed seeds from the Missouri River.

Seepage, the third issue, is being addressed by lining the canal with membrane lining to keep seepage to a minimum.

The irrigation districts chose to summarize the results of the PFWD in a brochure. They sent this brochure and a questionnaire to all irrigators in the basin. This was followed by meetings with the individual groups to discuss the specific results of the study and receive their input. Meetings will continue to be held during preparation of the Planning Report/ Environmental Impact Statement.

Scoping Session Summary

Scoping sessions for the Milk River Water Supply Study were held in Big Sandy and Malta, Montana, on June 18 and 19, 1985, respectively. No oral testimony was given at either session. However, during question and answer sessions at the end of the meetings, it appeared that the largest concerns were the alignment of the canal and weed control.

Earlier on the date of the first public scoping session, a meeting was held in Great Falls for Federal and State agencies. The following concerns were raised at that meeting.

1. Will water be available for BLM uses?

2. What will be the effects of the intake structure on the Missouri Basin Wild and Scenic River?

3. What effect will project withdrawals have on boat passage?

4. Will the canal be necessary with accomplishment of rehabilitation and conservation measures?

5. Where will fencing be located?

6. What will be the effect on streamside vegetation, sediment, etc., if Big Sandy were to be used as a conveyance facility?

7. What involvement is anticipated with the Canadians?

8. Will priorities be established for use of Tiber Dam water for fisheries?

9. How will the spawning areas, and larval fish, in Missouri River be affected?

10. Will a fish screen/filter be needed on the pumping plant intake?

11. What effects will return flows from canalside irrigation have on Big Sandy Creek?

12. How will weeds be controlled?

All records regarding the above meetings are maintained by the Great Plains Region, Bureau of Reclamation, Billings, Montana.

Coordination With U.S. Fish and Wildlife Service

According to the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service must provide an assessment of the effects of any action proposed by Reclamation. The U.S. Fish and Wildlife Service (USFWS) provided a preliminary assessment of the effects of the proposed project on fish and wildlife resources. USFWS draft recommendations are listed below.

A Coordination Act Report will be prepared by the UFWS for the Planning Report/Environmental Statement.

Recommendation 1. Mitigate reduction of flows in the Missouri River by altering the releases from Tiber Dam. In turn, depending upon how the releases from Tiber Dam are altered, the Marias River fishery could either be enhanced, degraded, or remain unchanged.

Response. Prior to completion of the Planning Report/Environmental Statement a plan to determine the best operation for both the Missouri River and the Marias River will be developed by the USFWS; Montana Department of Fish, Wildlife and Parks; Bureau of Land Management and the Bureau of Reclamation.

Recommendation 2. Prevent the transfer of carp from the Missouri River to the Milk River.

Response. The infiltration-gallery design for the pumping plant in the Missouri River would prevent transfer of carp.

Recommendation 3. The area of the Missouri River where the intake system would be located is known to have the highest densities of larval fish in the Middle River. In addition, paddlefish and shovelnose sturgeon may spawn in this area. Adverse impacts should be prevented.

Response. The infiltration-gallery design for the pumping plant would prevent impingement or entrainment of larval fish and fish eggs.

Recommendation 4. Construct powerline to minimize raptor electrocution.

Response. Powerlines will be constructed in accordance with Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1981.

Recommendation 5. To mitigate for loss of native rangeland within the canal right-of-way, the right-of-way must be fenced and seeded with native grasses and forb species.

Response. Adopted

Recommendation 6. To mitigate for loss of 1,315 acres of native rangeland in areas to be irrigated along the canal, lands in the Lonesome Lake area will be managed for wildlife.

Response. Adopted

The USFWS is presently working on enhancement proposals for Lonesome Lake and Big Sandy Creek. Those proposals will be evaluated when received, and would be subject to non-Federal cost sharing if adopted.

ATTACHMENT 1

The Milk River Simulation Model

Major data input to the model included historic streamflows, crop irrigation requirements, irrigation efficiencies, canal capacities, irrigated acreages, as well as reservoir capacities, area capacity tables, and seepage and evaporation tables.

Streamflows

Streamflow inputs define the available water supply for the Milk River Project. The Milk River has a streamflow regime governed primarily by snowmelt. Mean annual flow of the river at the eastern crossing of the border was 369 ft^3/s or 267,150 acre-feet/year. Of this, an average of 140,000 acre-feet/year was contributed from the St. Mary River Basin. Mean annual flow increases to 693 ft^3/s (501,700 acre-feet/year) near the river's mouth at Nashua. The model uses gauging records of streamflows for the mainstem of the Milk River at the international eastern crossing and 15 major tributaries. These gauges measure runoff from approximately 50 percent of the entire Milk River Drainage Basin. Missing records of the gauges and flows of ungauged contributing basins were estimated using standard hydrologic methods. Figure A-1 is a schematic diagram showing the relative location of tributaries in the Milk River Basin below the eastern crossing.

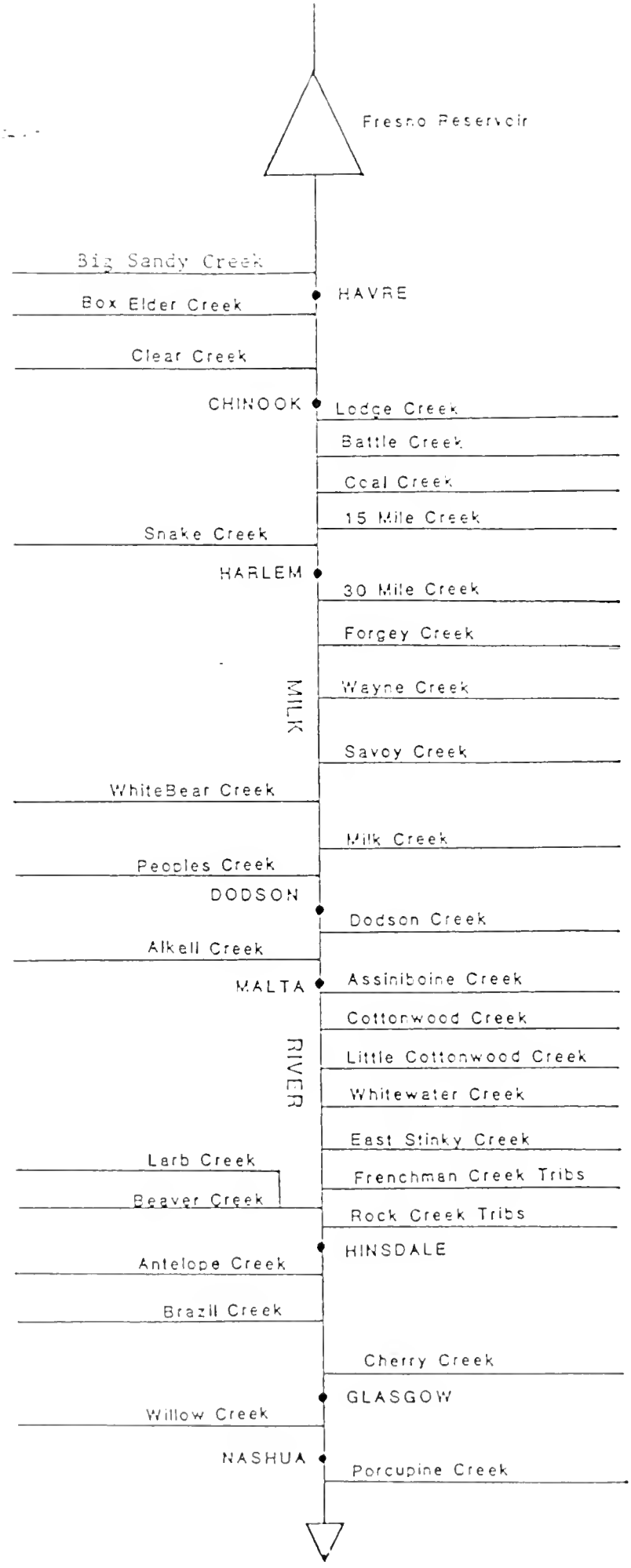


Figure A-1

Tributaries to the Milk River

Crop Irrigation Requirements

Crop irrigation requirements, in combination with irrigation efficiencies and irrigated acreages, were used to determine the total demand for irrigation water. On the more productive soils in the Milk River Project, alfalfa and small grains are the predominant crops with some land in irrigated pasture. Heavier soils are limited to production of western wheatgrass (known locally as "bluejoint" grass), a cool season crop characterized by low yields and relatively low water requirement. Table A-1 shows the percentage of each irrigated crop within the three divisions of the Milk River Project.

Table A-1. Crop Distribution of the Milk River Project (percent)

Crop	Chinook Division	Malta Division	Glasgow Division
Alfalfa	48	31	38
Grain	14	7	38
Pasture	9	22	4
Bluejoint Grass	29	40	20

Monthly crop irrigation requirements for alfalfa, small grains, and irrigated pasture were calculated for each division for each year, using the CIR77 program (USDOI, 1976) based on the Jensen-Haise evapotranspiration formula. The CIR77 program also accounts for soil characteristics, effective precipitation and irrigation practices in estimating the amount of irrigation water necessary to fully mature the crops. Lacking an appropriate crop coefficient for use in the Jensen-Haise formula, mean monthly irrigation requirements for native bluejoint grass were estimated and held constant from year to year. Bluejoint fields in the project are flooded early in the season when surplus water is usually available. During the rest of the season, other crops are generally given higher priority for irrigation water, so bluejoint fields are irrigated when water is available. Annual irrigation requirement for bluejoint was estimated to be 5 inches, of which 3 inches were distributed over the months of April, May, and June. Table A-2 gives the mean crop irrigation requirements for each division weighted for all crops.

Table A-2. Average Crop Irrigation Requirements in Inches (Weighted by Crop)

Month	Chinook Division	Malta Division	Glasgow Division
April	0.30	0.40	0.30
May	1.63	1.77	0.87
June	3.80	2.27	3.01
July	3.49	3.17	3.85
August	2.78	2.73	2.10
September	0.80	0.95	1.25
October	0.15	0.26	0.15
Total	12.95	11.55	11.53

Irrigation Efficiencies

Overall irrigation efficiency (the percentage of diverted water beneficially used by the crop) may be broken down into conveyance efficiency (the percentage of diverted water conveyed to the farm headgate) and onfarm efficiency (the percentage of water reaching the farm headgate delivered to the crop root zone). Two conveyance systems are used in the project: unlined earth canals are used to distribute water in the irrigation districts, with an average conveyance efficiency estimated to be 64 percent (SCS, 1978), and some individual irrigators who pump water directly from the river through pipelines to the farm site, at an estimated efficiency of 90 percent.

Onfarm efficiency depends on the method of irrigation. Approximately 80 percent of the Milk River Project is irrigated by gravity systems and 20 percent with sprinkler systems. Border dikes are the most common method of gravity irrigation.

Onfarm efficiencies of border dike systems in the project have averaged approximately 25 percent, estimated by Reclamation in conjunction with the SCS (USBR 1987). SCS measured onfarm efficiencies in 1986 in the counties where the project would be located, and has done efficiency studies on some Valley County farms for years.

Onfarm efficiencies for sprinkler systems are estimated to be 70 percent. Table A-3 summarizes conveyance and onfarm efficiency inputs to the Milk River model.

Table A-3. Estimated Irrigation Efficiencies (Percent)

	Onfarm	Conveyance	Overall
Bluejoint Grass			
River pumper gravity systems	25	90	23
Irrigation District gravity systems	25	64	16
All Other Crops			
River pumper sprinkler systems	70	90	63
Irrigation District gravity systems	27	64	17
Irrigation District sprinkler systems	70	64	45
Average (Weighted by Crop and Area)			22

Irrigated Acreages

Irrigated acreage was another data input needed to calculate the total demand for irrigation water. Irrigated acreage was based on the 1967-1968 water resources survey completed by the DNRC for Blaine, Valley, and Phillips Counties. Survey figures were updated by field observations during the 1985-1987 land classification (see "Lands to be Served," in Chapter 3). Acres irrigated by pumpers were identified in the field and subdivided into "contract" or "private" pumpers. (Contract and private pumpers could receive water directly from the river or from an irrigation district canal.) Table A-4 presents the irrigated acres used as input to the model.

Table A-4

IRRIGATED ACRES
MILK RIVER

	Acres
Fort Belknap Canal	
Fort Belknap District	6,050
Alfalfa Valley District	3,500
Zurich District	6,350
Junior Water Right Lands	270
Contract Pumpers	250
	16,420
Paradise Valley Canal	
Paradise Valley District	8,140
Junior Water Right Lands	430
	8,570
Harlem Canal	
Harlem District	10,680
Junior Water Right Lands	80
	10,760
Fort Belknap Indian Reservation	10,420
Dodson North Canal	
Dodson District	1,010
Malta District	9,350
Contract Pumpers	470
Junior Water Right Lands	720
	11,550
Dodson South Canal	
Malta District	15,700
Contract Pumpers	1,220
Junior Water Right Lands	1,480
	18,400
Nelson Canal	
Malta District	17,100
Contract Pumpers	360
Junior Water Right Lands	570
	18,030
Vandalia Canal	
Glasgow District	15,000
Junior Water Right Lands	850
	15,850

Table A-4
IRRIGATED ACRES
MILK RIVER
(Continued)

	Acres	
Junior Water Right Lands		
From Fresno to Havre	650	
From Havre to Chinook	450	
From Chinook to Harlem	390	
From Harlem to Malta	3,100	
From Malta to Saco	2,850	
From Saco to Hinsdale	240	
From Hinsdale to Vandalia DD	10,710	
From Vandalia DD to Nashua	1,800	
	20,200	
Contract Pumpers		
From Havre to Fort Belknap DD	1,350	
From Fort Belknap DD to Paradise Valley DD	860	
From Paradise Valley DD to Harlem	480	
From Harlem to Dodson Diversion Dam	1,110	
From Dodson Diversion Dam to Malta	180	
From Malta to below Nelson North Canal	2,030	
From Nelson North Canal to Vandalia DFD	2,020	
	8,030	
Subtotal along Canals		110,000
Districts	92,900	
Fort Belknap Indian Reservation	10,400	
Contract Pump	(2,300)	
Junior Water Right Lands	(4,400)	
Subtotal along River		28,230
Contract Pumpers	(8,030)	
Junior Water Right Acres	(20,200)	
Total Irrigated		138,230
Subtotal Junior Water Right		24,600
Along Canals	4,400	
Along River	20,200	
Subtotal Contract Pumpers		10,330
Along Canals	2,300	
Along River	8,030	
Total Pumpers		34,930

General Calculations

Crop irrigation requirements and irrigation efficiencies were used to calculate monthly diversion requirements to satisfy the area served by each canal. When total monthly demand on the canal exceeded the canal capacity, demand was reduced to capacity. In this case, a facility shortage was calculated as the increment of demand beyond the canal capacity. Facility shortages are significant in evaluating Milk River irrigation shortages as they cannot be remedied by an increase in water supply alone.

Monthly return flows for each district were estimated by subtracting crop consumptive use and an estimate of irrecoverable loss[1/] from the total irrigation diversion. The volume available as return flows was then lagged over a 3-month period, with 70 percent of the volume returning in the month of the irrigation, 20 percent the next month, and 10 percent in the third month.

While a longer duration for return flows is more typical, the 3-month distribution period was used for two reasons. First, typical operations of Milk River districts results in large operational wastes, and thus a large portion of return flow occurs through surface channels as opposed to groundwater flow. Also, calibration runs of the model which compared simulated and historic streamflows were made with various return flow distributions. From these runs, a 3-month distribution of return flow seemed most appropriate for the Milk River Basin.

To establish demand on the reservoirs, the spatial distribution of demands with respect to tributary flows and return flows was analyzed. The Fort Belknap Reservation was given priority use of all tributary inflows upstream of the reservation. When upstream tributary inflows exceeded the

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[1/] Irrecoverable losses are water losses from the distribution system which cannot be returned to the river within 1 year. Examples are evaporation from canals, nonbeneficial evapotranspiration, deep percolation, and wind drift.

reservation's demands, the increment above the reservation demand was considered available for use by the non-Indian districts. Total demand on the reservoirs was equal to the sum of the demands in excess of the tributary inflows and return flows available for use at each demand point. Nelson Reservoir is sometimes dependent on Fresno Reservoir for its inflows, so a trial operation of Nelson was done each month to establish its demand on Fresno.

Once Fresno demands were set, final reservoir computations were done. Inflows to Fresno (natural flows and water diverted from the St. Mary River Basin) were apportioned between the Fort Belknap Reservation and the non-Indian districts. Releases from Fresno were used to satisfy irrigation and municipal demands, and then end-of-month (EOM) storage volumes were calculated. Distinctions between Indian and non-Indian releases and storage volumes were maintained in all computations and releases were made within the constraints of operating criteria. When demands on Fresno Reservoir were low, a minimum release of 25 ft^3/s was maintained. Releases in the summer months may be reduced to maintain a minimum storage of 10,000 acre-feet for municipal demands through the fall and winter. In the winter months, Fresno Reservoir storage levels were forecast, and if necessary, drawdown releases were made to reduce storage to 70,000 acre-feet by March 1. Reservoir evaporation for each month was calculated from estimates of the mean reservoir surface area for the month and mean monthly evaporation derived from local evaporation pan data.

With Fresno operations completed, releases were routed through the system by the model. Diversions and return flows at each demand point were simulated in a downstream sequence, with shortages computed and return flows recalculated based upon the simulated diversion. Accounting of Indian and non-Indian water was maintained through the system. Flows were routed through Nelson Reservoir, where calculation of releases, evaporation, seepage, and EOM content were made. Mainstem streamflows of the Milk River were estimated at 17 nodes, 6 of which have historic gauging records for comparison.

Comparison of Model Results With Historic Flows

To determine the accuracy and applicability of the model, a baseline run simulating historic conditions was made. The stream gauge at Havre, the first gauge on the Milk River mainstem below Fresno Reservoir, was used to demonstrate how accurately Fresno releases were simulated. Correlation analysis using the Havre gauge revealed simulated and historic values correlated significantly (a 5 percent significance level for a T-test was used in all analyses) for both annual flows and May through September irrigation season flows. Annual correlation had an "R" of .95. Figure A-2 shows a plot of the annual hydrographs of mean monthly values for both simulated and historic flows at the Havre gauge.

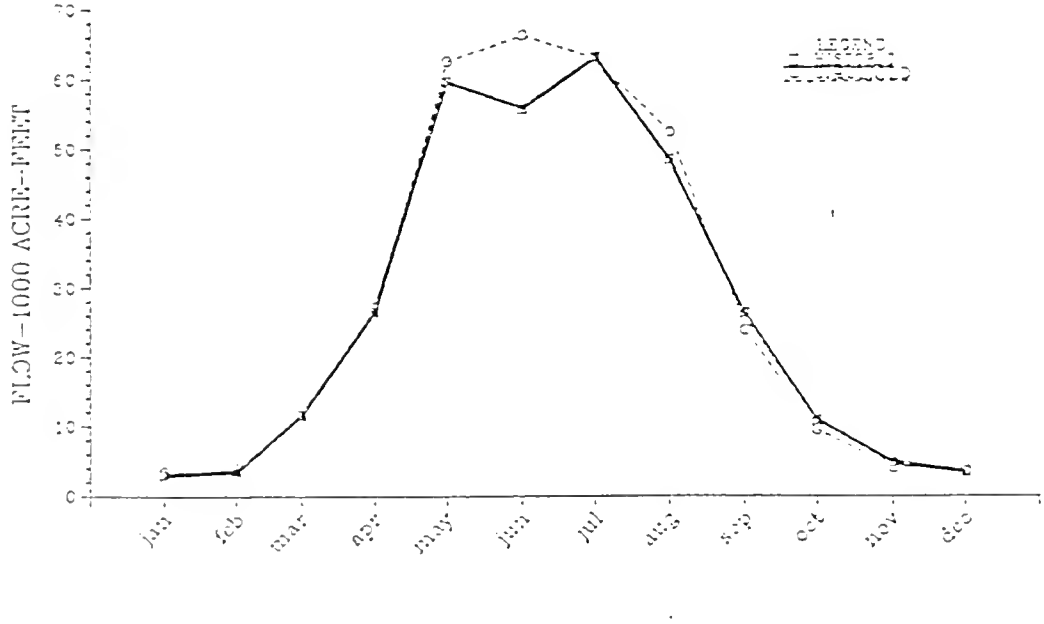

Figure A-2. Historic and simulated hydrographs of mean monthly flows of the Milk River at Havre for the period 1955-1985.

The last gauge on the Milk River mainstem at Nashua is 21 river miles upstream of the mouth. Model results at this site indicated how well the total operation of the Milk River Irrigation Project was simulated. Correlation analysis using the Nashua gauge showed that simulated and historic values correlated significantly for both annual flows and May through September irrigation season flows. Annual correlation had an "R" of .96.

Figure A-3 shows a plot of the mean annual hydrographs of simulated and historic flows at the Nashua gauge.

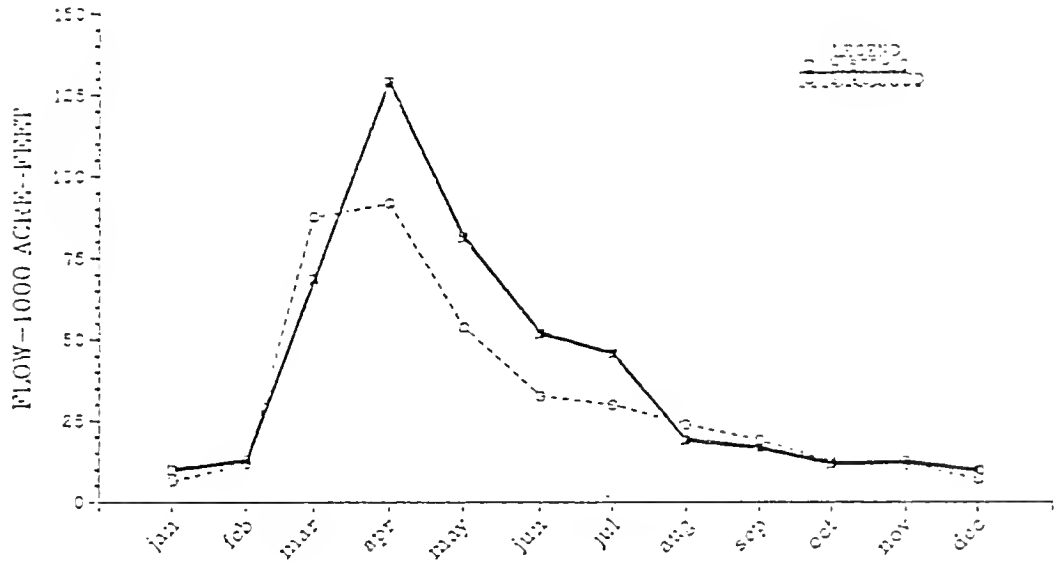

Figure A-3. Historic and simulated hydrographs of mean monthly flows of the Milk River at Nashua for the period 1955-1985.

Comparison of model results with historic flows at the Havre and Nashua gauges revealed that the model accounted for the variability of historic flows but did not accurately duplicate the historic flow. Inspection of the data showed that the simulated flows consistently deviated from historic flows at both gauges during high flow years, perhaps because a significant part of tributary inflow in the basin is ungauged and would have to be estimated. Estimating techniques, unfortunately, would not accurately represent high flow

nditions. And, while certain characteristics of the irrigation systems vary rom year to year depending upon moisture and other conditions, they were represented in the model by constants. Constant values of factors like the bluejoint grass irrigation requirement and irrigation efficiencies were probably more representative of low rather than abnormally high water conditions. Table A-5 shows a comparison of simulated flows with historic flows for the 10 driest years during 1955-1985. A paired T-test revealed the simulated flows for these years were not significantly different from historic for either irrigation season or annual flows at the two gauges. The conclusion, is therefore, that the Milk River model is best suited for simulating average and below average water supply conditions, appropriate to our primary objective of evaluating irrigation shortages in the basin.

Table A-5. Comparison of Simulated Flows with Historic Flows at Two Locations for 10 Low-Flow Years in the Period 1955-1985

Gauging Site	Historic Mean Annual Flow (1,000 ac-ft)	Simulated Mean Annual Flow (1,000 ac-ft)	Historic Mean Irrigation Season Flow (1,000 ac-ft)	Simulated Mean Irrigation Season Flow (1,000 ac-ft)
Havre	238.1	236.1	204.5	197.5
Nashua	162.0	163.1	59.4	60.8

Results of the model are listed in Chapter 3, "Resources."

ATTACHMENT 2

ECONOMIC CRITERIA

FARM BUDGET ANALYSIS

The farm budget method of analysis was used to determine both the benefits and repayment ability of the project lands. Composite budgets were prepared to reflect the varying farming practices and land uses along the Milk River. These budgets incorported data from Blaine, Phillips, and Valley Counties.

Repayment budgets were done for the year 1995 to represent those irrigated lands, receiving a full water supply and those lands receiving a supplemental water supply. These budgets were considered to depict the baseline conditions and the anticipated repayment ability in the first year of project service. This set of budgets were extended to illustrate typical benefits levels over the life of the project.

Farm Size

The composite farm size represents the modal size for the three counties located within the proposed project area. Derivation of the modal farm size is shown in Table A-6. The 7,753-acre size was further verified from additional sources and local interviews.

In accordance with Principles and Guidelines (Water Resources Council: see "References") requirements, the farm size was projected for repayment purposes to represent the 1995 level and benefit farms at the economic mid-point of the benefits (8 years at 8.625 percent). The projection was made through the use of a linear analysis of USDA census data. This procedure yields a repayment size of 8,764 acres and a benefit size of 9,400 acres.

Land Use

The major reason for the large units is the vast amount of low yielding rangeland (approximately 7 acres per cow-calf unit per month) required to maintain the cow herd. Range accounts for about 74 percent of the land in the three county area. The rangeland in the composite budget also accounts for 74 percent of the land area in the unit. Cropland, fallow, and miscellaneous unproductive land accounts for the remaining farm acreage.

Specific information comparing county data and farm budgets is presented in Table A-7. The crop distribution used in the farm budget is as follows.

	Crop Distribution (Percent)	
	Without Project	With Project
Irrigated Alfalfa Hay	---	1.59
Irrigated Barley		.39
Irrigated Pasture		.48
Irrigated Other Hay		1.00
Irrigated Alfalfa Seed		.06
Irrigated Spring Wheat		.19
Irrigated Waste		.13
Dryland Barley	2.00	1.48
Dryland Fallow	9.08	8.53
Dryland Wheat	9.29	6.88
Dryland Other Hay	.51	.38
Dryland Alfalfa Hay	.40	.30
Owned Range	31.11	31.11
Leased Range	43.33	43.33
Dryland Unproductive	4.28	4.15
	100.00	100.00
Straw	9.08	9.10

Irrigated Acres

According to the 1982 Census of Agriculture, there are 115,998 irrigated acres in the three county study area. Over 61 percent of these lands are in farms larger than 2,000 acres. An average of 198 acres is irrigated in these large farms (Table A-8). Although the acreage listed above is shown as irrigated in

in the farm budgets, the actual number of acres irrigated in the farm budgets is slightly less to allow for irrigation waste for ditches, O&M roads, etc.

Dryland Acres

The dryland crop rotations in the farm budgets were developed using Blaine, Phillips, and Valley County dryland crop statistics. The basic dryland crop rotation has remained much the same for the past 20 years. However, the recent trend has been toward slightly more small grain crops at the expense of the hay crops. Therefore, the last 5 years of published data (1981-1985) was used for the dryland crop rotations (Table A-7). It was assumed that the

Table A-6

Land in Farms Plus Harvested Cropland
for Farms with Irrigation
Blaine, Phillips, Valley Counties, 1982

Farms by Land in Farms (acres)	Farms (No.)	Farms (%)	Total Acres (No.)	Total Acres (%)	Harvested Cropland (No.)	Harvested Cropland (%)
1- 9	4	.7	D	---	D	--
10- 49	30	5.3	213	---	140	.1
50- 69	7	1.2	242	---	122	--
70- 99	20	3.5	1,629	.1	696	.3
100- 139	18	3.2	1,844	.1	1,121	.4
140- 179	22	3.9	3,428	.2	1,848	.7
180- 219	20	3.5	3,842	.2	1,621	.6
220- 259	19	3.3	4,544	.2	1,862	.7
260- 499	69	12.2	24,794	1.3	11,792	4.1
500- 999	55	9.7	39,754	2.0	17,757	6.2
1000-1999	65	11.5	93,016	4.6	26,687	9.2
2000+	238	42.0	1,845,145	91.3	224,802	77.7
TOTAL	567	100.0	2,020,438	100.0	289,615	100.0
Mean			3,563		511	
Mode		2,000 + acres	7,753		945	

Source: 1982 Unpublished U.S. Bureau of Census Data Tapes, Montana, Land in Farms and Harvested Cropland for Farms with Irrigation.

D = Not published to avoid disclosure.

Table A-7

Comparison of Gross Land Use in
Farms with Irrigation in Blaine, Phillips,
and Valley Counties (1982 and the Farm Budgets)

Item	Composite			
	County Statistics		Farm Budget	
	Acres	%	Acres	%
Land in Farms	2,020,438	100	7,753	100
Harvested Cropland	288,985	14	989	13
Fallow	177,876	9	667	9
Rangeland	1,498,974	74	5,771	74
Unproductive-Farmstead	54,603	3	322	4
Irrigation-Waste	---	--	10	--

Source: 1982 U.S. Census of Agriculture, Volume 1, Geographic Area Series, Part 26, Montana State and County Data, Table 2 Irrigation, Pages 132, 134, and 135 - Published by U.S. Department of Commerce, Bureau of the Census.

Table A-8

Irrigated Acres by Farm Size
Blaine, Phillips, Valley Counties

Acres	Number of Farms	Total Irrigated Acres	%	Average No. of Irrigated Acres by Farm Size
1- 9	4	D	D	D
10- 49	30	158	.1	5
50- 69	7	156	.1	22
70- 99	20	879	.8	44
100- 139	18	1,310	1.1	73
140- 179	22	1,905	1.6	87
180- 219	20	1,742	1.5	87
220- 259	19	2,229	1.9	117
260- 499	69	10,945	9.4	159
500- 999	55	12,148	10.5	221
1000-1999	65	13,116	11.3	202
2000+	238	70,862	61.1	298
TOTAL	567	115,998	99.4	205

Source: 1982 Census of Agriculture, Volume 1, Geographic Area Series, Part 26, Montana State and County Data, Table 4 - Land in Farms, Harvested Cropland, and Irrigated Land, Page 160

Table A-9

Composite Summary of Major
Dryland Crop Acreage

Year	Acres			
	Barley	Wheat	Alfalfa	Other Hay
1966	161,600	362,500	24,500	85,700
1967	121,400	449,200	25,800	59,500
1968	127,600	398,700	25,000	63,600
1969	143,800	344,800	30,000	72,100
1970	146,900	332,100	33,000	69,500
1971	115,000	455,900	32,300	53,700
1972	163,900	426,400	30,700	105,900
1973	184,800	461,000	25,700	73,600
1974	116,700	517,500	32,800	62,700
1975	120,400	546,500	26,700	47,200
1976	100,500	603,700	36,200	53,500
1977	114,600	567,100	38,700	53,500
1978	93,500	563,500	39,500	94,400
1979	67,800	596,300	33,500	75,300
1980	58,800	593,700	24,000	39,900
1981	70,100	659,200	32,000	38,200
1982	109,200	677,000	31,400	49,900
1983	133,600	528,400	26,000	37,900
1984	177,300	527,500	18,600	10,700
1985	117,000	431,900	13,300	18,100
20-Year Average				
Acres	122,225	502,145	28,985	55,110
%	17.2	70.9	4.1	7.8
10-Year Average				
Acres	104,240	574,830	29,320	47,140
%	13.8	76.1	3.9	6.2
5-Year Average				
Acres	121,440	564,800	24,260	30,960
%	16.4	76.1	3.3	4.2

Source: Montana State Agricultural Statistics 1966-1985.

irrigated crop rotations would not change under dryland conditions; therefore, the dryland percentages on the "without" irrigation budget were increased to include the irrigated crops. The irrigated pasture was converted to other hay.

Irrigated and Dryland Yields

Projected yields were obtained by developing a yield trend line using a linear regression analysis of the previous 20 years of record data. The maximum yields were obtained through a literature search pertaining to the project area. The trend line was projected until the maximum yields would be achieved. The benefit analysis yields used were developed by determining when the highest yields would be achieved and spreading this throughout the life of the project. These yields do not exceed those currently being attained by better farmers in the area and are considered representative of future conditions. The irrigated yields are summarized in Table A-10, and hayland crop yields are shown on Table A-11. The rangeland yield of .15 AUM's per acre was based on information supplied by the Bureau of Land Management. The projected crop yields used in the analysis are shown below (benefit yeilds are after implementation, repayment before).

	Benefit	Repayment
Irrigated		
Alfalfa Hay (tons)	5.0	3.6
Barley (bushel)	73.8	67.0
Pasture (AUM's)	8.7	8.4
Other Hay (tons) 1/	3.9	2.0
Alfalfa Seed (cwt's)	3.2	3.1
Spring Wheat (bushel)	90.6	77.1
Dryland		
Wheat (bushel)	31.9	
Barley (bushel)	33.6	
Other Hay (tons)	1.0	
Alfalfa Hay (tons)	1.5	
Range (AUM's)	1.5	

1/ Includes bluejoint, alfalfa brome, mixed grasses, grain hay.

Table A-10

Irrigated Crop Yields

Year	Barley (Bu.)	Spring Wheat 1/ (Bu.)	Alfalfa Hay 2/ (Ton)	Pasture 2/ (AUM)	Other Hay 2/ (Ton)	Alfalfa Seed 2/ (CWT)
1966	48.2	32.8	2.8	3.4	1.1	---
1967	47.2	26.2	2.8	3.1	1.0	---
1968	35.8	35.8	3.0	3.1	1.1	---
1969	46.7	32.4	3.1	3.0	1.1	10
1970	48.9	32.1	3.0	3.0	1.2	---
1971	41.4	30.1	2.8	4.2	1.2	---
1972	53.7	35.8	2.9	5.7	1.3	---
1973	45.0	38.1	3.0	5.3	1.4	---
1974	45.7	41.8	2.8	5.3	1.5	---
1975	47.0	36.4	3.0	7.3	1.4	1.0
1976	46.5	40.4	3.1	7.0	1.3	---
1977	49.1	47.6	2.9	7.0	1.3	1.1
1978	57.8	40.8	2.8	6.5	1.5	---
1979	59.2	38.4	2.9	6.6	1.3	4.63
1980	46.4	45.0	2.9	5.3	1.6	3.22
1981	58.1	49.4	3.3	3.9	1.6	1.80
1982	58.8	53.8	3.5	5.1	1.7	1.06
1983	53.2	53.2	3.4	4.6	1.6	1.78
1984	51.6	49.8	2.3	5.0	1.1	3.68
1985	35.7	50.6	2.3	4.9	1.2	1.68
Mean (s)	48.80	40.53	2.93	4.97	1.33	2.55 4/
Standard Dev. (2s)	6.76	8.14	.30	1.43	.20	---
Standard Dev. X = Outside 2s	13.52	16.27	.60	2.85	.40	---
Unadj. R2	.34	.91	-.04	.46	.58	---
Adj. R2 (1995)	NA	NA	NA	NA	NA	---
Unadj. Yield (1995)	56.34	64.81	2.89	7.13	1.72	---
Adj. Yield	NA	NA	2.94 3/	NA	NA	---
Yield Used	56.3	64.8	3.0	7.1	1.7	2.6

1/ Composite Montana Agricultural Statistics for Blaine, Phillips, Valley Counties.
2/ USBR Statistics for Milk River Projects.
3/ 10-Year average (1976-1985).
4/ Based on the last 7 years of data.

Table A-11

Dryland Crop Yields

Year	Barley 1/ (Bu.)	Wheat 1/ (Bu.)	Alfalfa Hay 1/ (Ton)	Other Hay 1/ (Ton)
1966	34.6	23.4	1.3	1.0
1967	20.1	16.0	1.3	.8
1968	37.6	20.6	1.2	1.0
1969	36.8	24.8	1.3	1.1
1970	35.1	23.4	1.5	1.0
1971	28.5	20.0	1.0	.9
1972	37.1	25.0	1.4	1.2
1973	31.7	23.5	1.0	1.0
1974	30.7	22.6	1.7	1.1
1975	31.5	35.0	1.7	1.0
1976	41.7	28.2	1.3	1.2
1977	33.4	24.2	1.5	1.1
1978	42.8	29.3	2.0	1.4
1979	27.8	19.4	1.4	1.0
1980	26.0	23.4	1.4	.8
1981	30.8	22.3	1.6	1.0
1982	42.9	32.0	1.8	1.2
1983	31.9	27.3	1.1	.7
1984	20.8	18.6	.7	.7
1985	12.9 x	10.2 x	.5 x	.5 x
Mean	31.24	22.96	1.34	.99
Standard Dev. (s)	7.63	4.81	.36	.21
2 Standard Dev. (2s)	15.26	9.63	.72	
X = Outside 2s				
Unadj. R2	-.19	-.00	-.14	-.31
Adj. R2	.04	.33	.08	-.13
Unadj. Yield (1995)	33.50	23.02	1.16	.77
Adj. Yield (1995)	33.06	27.95	1.46	.93
Yield Used	33.1	28.0	1.5	1.0 2/

1/ Composite Montana Agricultural Statistics for Blaine, Phillips, and Valley Counties.

2/ Based on 20-year mean (1966-1985).

Prices Received

The prices received are based on the most recent 20-year local prices received. The corresponding Gross National Product deflator for each price year is used to compute a 20-year average constant price. This price is then reindexed to the current year for use in the farm budget analysis. This methodology brings the prices paid and received to a common point.

Barley	$ 2.66/bu.
Wheat	4.15/bu.
Alfalfa Seed	107.00/cwt
All Hay	72.82/ton
Alfalfa Hay	73.89/ton
Other Hay	65.46/ton
Cows	47.53/cwt
Heifers - Replacement	72.95/cwt
Heifers - Feeder Calves	75.96/cwt
Steers - Feeder Calves	79.88/cwt
Bulls	62.20/cwt

Prices Paid

The following prices paid were used in the analysis.

	Unit	Level	Dollars/Unit
Seed Costs			
Barley	bu.	actual	5.40
Wheat	bu.	actual	6.60
Alfalfa - Certified	cwt.	actual	235.00
Pasture	cwt.	actual	87.00
Fertilizer Costs			
Ammonium Nitrate, 33.5 percent N	ton	actual	200.81
Super Phosphate, 45 percent P205	ton	actual	262.76
Other Costs			
Fargo	gal.	actual	36.08
2, 4-D	gal.	actual	9.50
Malathion, 5 lbs./gal.	5 gal.	actual	86.30
2, 4-DB Amine	5 gal.	actual	69.50
Twine	bale	actual	19.85
Skilled Labor	hr.	actual	4.85
Hired Labor	hr.	actual	3.75
Insurance - Buildings	$1,000	actual	4.35
Insurance & Licenses - Cars & Trucks	total	actual	640.00

Prices Paid, (continued)

Other Costs, (continued)

Insurance - Farm Liability	total	actual	92.00
Telephone - Farm Share	total	actual	500.00
Electricity - Farm Share	total	actual	925.50
Regular Gas, Bulk	gal.	actual	1.17
Diesel Fuel	gal.	actual	.96
Oil	qt.	actual	1.07
Filters - Car & Trucks	total	actual	3.85
Filters - Tractors, Swathers, Combine	total	actual	12.00

Livestock Expenses

Marketing Costs			
Hauling (50-60 miles)	cwt.	actual	.43
Buying & Selling Commission	cwt.	actual	.43
Miscellaneous Costs			
Salt & Minerals	cwt.	actual	33.00
Vet Medicine	cow	actual	7.00
Barley Cake	cwt.	actual	6.86
Barley Pellets	cwt.	actual	7.37
Barley Rollings	cwt.	actual	.45

NED IRRIGATION BENEFITS

Net farm incomes were taken from the farm budgets representing the condition with and without the project. The net increase with the project is $51,692/farm (see Table A-12). Farm budgets are included in the Economic Appendix (in a separate volume).

Net farm incomes was taken from the budget. From the increase net income, allowances for management and labor were deducted. The management allowance was derived using 10 percent factor of the increased net farm income. The additional labor required was used to determine the labor allowance. A summary of irrigation benefits is shown in Table A-12. The annual irrigation benefit is $142-per acre.

Table A-12

Annual National Economic Development (NED) Irrigation Benefits

	Full Service
Net Farm Income With Project	$-19,085
Net Farm Income Without Project	-73,228
Increase Net Income/Farm	$ 54,143
Less:	
6 Percent of Variable Production Costs	1,029
Labor Allowance	1,692
NED Irrigation Benefits Per Farm	$ 51,692
Acres Irrigated	361
NED Benefits Per Irrigated Acre	$ 142

The "without the project" budget represents dryland farming. The privately irrigated lands along the canal route and the land to be served on Rocky Boy's Reservation are presently dryland farm operations. The benefit for each acre irrigated is $142. The same benefit value per acre was used for the land irrigated by landowners with junior water right and the lands on Fort Belknap Reservation. However, the number of acres for which benefits were claimed was based on the dryland equivalent acreage. That is, of the 24,425 acres assumed to be irrigated on the Fort Belknap Reservation, 9,850 acres would have to be taken out of production in order for the remaining lands to receive a full water supply. (Full water supply is defined by Reclamation guidelines as shortages cannot exceed 50 percent in any 1 year or 100 in any 10 consecutive years.) Benefits of $142/acre were claimed for 9,850 acres.

In the case of the lands irrigated under junior water rights, $142/acre benefits were claimed for the entire 25,000 acres. After adjudication, these lands would have no water supply at all during extremely dry years, and diversions would be reduced over 10 percent in 6 out of 10 years. There is not adequate water supply to provide a full water supply to these lands, landowners should revert to dryland operation.

PAYMENT CAPACITY

The payment capacity per acre is estimated to be $19.63 (see Table A-13). Based on the repayment farm budget, the net farm income with the project, projected to year 1995, is $27,355. The standard family living allowance (per Department of the Interior criteria) is $20,800. This leaves a payment capacity of $6,556 per farm. Assuming there are 334 irrigated acres per farm, the payment capacity per acre is $19.63.

Table A-13

Payment Capacity

Net Farm Income, With Project		$31,443
Net Farm Income, Without Project		4,088
Net Farm Income, With Project		$27,355
Less:		
Family Living Allowance 1/		
Management Return 2/	(2,736)	
Labor Allowance 3/	(2,097)	
Equity Allowance 4/	(695)	
Balance of Living Allowance	(15,271)	
		$20,794
Available Payment Capacity		$ 6,556
Acres Served		334
Payment Capacity Per Acre		$ 19.63

1/ Standard family living allowance is $20,800 per Department of the Interior criteria.

2/ Ten percent of increase net farm income.

3/ Increased labor for irrigation.

4/ 3.4 percent of equity increase.

Attachment 3

This attachment presents a summary of the Rehabilitation and Betterment, Construction and Rehabilitation, and Onfarm Efficiency Improvement Elements. These elements are presented in detail in the Rehabilitation and Betterment Reports for the Glasgow, Malta, Chinook (includes Dodson Pump) Divisions.

Rehabilitation and Betterment Element

Glasgow Division

1. Place a slip-form concrete lining or pipe in 22 miles of laterals

2. Line the Vandalia Canal with compacted earth

3. Replace the concrete lining of 500 feet of the Vandalia Canal

4. Realign, deepen, and rehabilitate ____miles of open drains and construct additional drains

5. Install Parshall Flume measuring devices at diversion points of project laterals and at delivery points of laterals scheduled for rehabilitation.

Malta Division

1. Install a new lift system for a movable crest on the Dodson Diversion Dam

2. Realign, reshape, and complete earthwork on reaches of the initial 5 miles of the Dodson South Canal

3. Replace eight check structures on the Dodson South Canal with new radial gate check structures

4. Relocate the terminal reach of the Bowdoin Canal

5. Enlarge the first 3-mile reach of the Dodson North Canal

6. Replace two flumes on the Dodson North Canal with siphons

7. Install a PVC membrane lining on a 7-mile reach of the Dodson South Canal

8. Replace the gate lifts on the headworks of the Nelson South, Nelson North, Dodson South, and Bowdoin Canals and on the Points-of-Rocks Reservoir

9. Install slip-form concrete linings on 27 miles of laterals

10. Install pipe in 8 miles of laterals

11. Repair concrete on cross drainage culvert transitions, lateral turnout structures, siphon transitions, and check structures

12. Rehabilitate 30 miles of open drains

13. Construct 7 miles of new drains

14. Install Parshall Flume devices at diversion points of laterals and onfarm delivery points of laterals being rehabilitated.

Chinook Division

1. Place slip-form concrete lining or pipe in 18 miles of laterals

2. Reshape earth lateral and place compacted earth lining in 61 miles of canals and laterals

3. Place PVC membrane lining in 10 miles of the Fort Belknap Canal, 5 miles of the Paradise Valley Canal and 6 miles of the Harlem Canal

4. Repair the necessary structures

5. Realign, deepen, and rehabilitate open drains and build additional drains.

Construction and Rehabilitation Element
Glasgow Malta and Chinook Division

1. Replace the Dodson Diversion Dam and modify the Fort Belknap Diversion Dam

2. Install buried membrane linings in 4 miles of the Dodson South Canal, 16 miles of the Dodson North Canal, 2.25 miles of the Bowdoin Canal, 3 miles of the Nelson South Canal, 5.5 miles of Lateral NS 25, 14 miles of the Fort Belknap Canal, 5 miles of the Paradise Valley Canal, 6 miles of Harlem Canal, 16 miles of the Vandalia Canal and 20 miles of laterals

3. Install concrete linings in .6 mile of the Vandalia Canal and in 80 miles of laterals

4. Construct 14 miles of pipe laterals

5. Reshape 45 miles of earth laterals

6. Replace 1,000 turnout structures

7. Install 1,300 new measuring devices

8. Construct 10 new check structures

9. Install automated slide gates on the headworks of the Fort Belknap and Paradise Valley Canals

10. Construct 100 miles of O&M roads and gravel surfacing 150 miles of roads

11. Rehabilitate and extend 114 miles of drains

12. Install devices for remote monitoring, supervisory control and automation

13. Construct six new shop and storage buildings and three new headquarters buildings

14. Mitigate impacts to wildlife habitat.

Onfarm Efficiency Improvement Element
Glasgow, Malta, and Chinook Division

The goals of onfarm improvement are to conserve water by reducing the irrigation demand, increase crop production through more efficient use of water, decrease labor required for farm operations, and distribute water more equitably throughout the Milk River Basin.

Onfarm conservation requires two parts: the implementation of a basin-wide irrigation management system, and a program of onfarm improvements and operational changes designed to increase the irrigation efficiency by 15 percent over the present level.

The management system will be controlled by a single water master responsible for distributing water throughout the basin in an equitable and efficient manner. Scheduling and distribution of water will be based on up-to-date flow information from the measuring devices included in the rehabilitated delivery system. Irrigation records for each delivery will be recorded and incentives included in a revised rate structure, with graduated rates and surcharges to motivate irrigators to be more efficient. Consulting and educational services will also be provided to design onfarm improvements and to assist in basin-wide irrigation scheduling.

Onfarm improvements are designed to raise irrigation efficiency from its average estimated 27 percent, to about 42 percent. Improvements include field leveling, border dikes, gated pipes, concrete-lined head ditches, sprinklers, re-use pits and automated controls on head ditches. Operational changes will also be made to make the improvements effective, including shorter irrigation set times and more efficient scheduling of irrigation applications.

The onfarm program depends on an efficient and the well-maintained distribution system brought about by the Rehabilitation and Betterment and Construction and Rehabilitation elements. The three elements could be implemented at the same time.

Cost estimates for each type of physical improvement were based on a sample application and then reduced to a cost per acre. These costs were then multiplied by the number of acres assumed to be included for each type of improvement in order to arrive at a total estimated project cost. These costs include installation of measuring devices at all delivery turnouts. Costs also include 10 percent unlisted, 15 percent contingency and 15 percent indirect, except for sprinklers and gated pipe. The costs for concrete-lined ditches was estimated using information obtained from the Soil Conservation Service and Greenfield Irrigation District; 15 percent indirect costs were added to this.

Table A-14 displays an array of measurements and plans with associated costs and water savings. An onfarm plan that would achieve a 15 percentage point efficiency increase would cost about $20,000,000.

Table A-14
Onfarm Improvement, Costs and Water Savings

	(1)	(2)	(3)			(4)			(5)			(6)		
Plan Number			#1			# 2			# 3			# 4		
Conservation Method	% Eff. Change	Cost/ Acre	% Part.	% Water 1/ Savings	Cost 2/	% Part.	Water Savings	Cost	% Part.	Water Savings	Cost	% Part.	Water Savings	Cost
Sprinklers	47	$550	8	3.8	4.1	10	4.7	5.1			—			—
Land Leveling	6	270	11	.7	2.8	24	1.4	6.0	40	2.4	10.0	28	1.7	7.0
Border Dikes	6	10	11	.7	.1	29	1.7	.3	40	2.4	.4	40	2.4	.4
Concrete Head Dikes	3	300	5	.2	1.4	12	.4	3.3	—	—	—			
Automated Gates (Requires Concrete Ditches)	15	100	5	.8	.5	10	1.5	.9	—	—	—			
Gated Pipe	6	180	5	.3	.8	12	.7	2.0	65	3.9	10.9	65	3.9	10.9
Operational Changes														
a) Shorter Irrigation Sets	12	—	10	1.2	—	25	3.0	—	35	4.2	—	35	4.2	—
b) Change in Number and Timing of Irrigation	8	—	10	.8	—	20	1.6	—	35	2.8	—	35	2.8	—
SUBTOTAL				6%	9.7		15%	17.6		16%	21.3		15%	18.3
TOTAL Including Measuring Device at Delivery Turnouts					11.7			19.6			23.3			20.3

1/ Water savings is calculated by multiplying the percent efficiency change by the percent participation.
2/ Cost is calculated by multiplying the percent participation by 93,000 acre (total number of acres irrigated by district and contract pumpers that are not sprinkler irrigated) and then multiplying by the cost per acre.

Col. (1): Percent Efficiency Change: This is the onfarm efficiency increase expected if the conservation measure is implemented. The present condition was assumed to be 27 percent efficient.
Col. (2): Cost/Acre: Estimated cost per acre for implementing each conservation measure.
Col. (3): #1 Plan: This plan represents a participation level assuming cost sharing farm improvements and minor rate structure changes for water which would result in an 8 percent water savings.
Col. (4): #2 Plan: This plan is a modification of #1 plan assuming higher landowner participation through stronger rate structure incentives. Water savings would be 15 percent.
Col. (5): #3 Plan: This plan was formulated assuming sprinkler and concrete head gates and automation would not be included and assuming a higher participation in operational changes.
Col. (6): #4 Plan: Same as #3 plan except land leveling has been adjusted so the total efficiency increase is 15 percent for comparison to other plans.

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